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COMPANION
TO
MIDDLETON'S
CELESTIAL ATLAS

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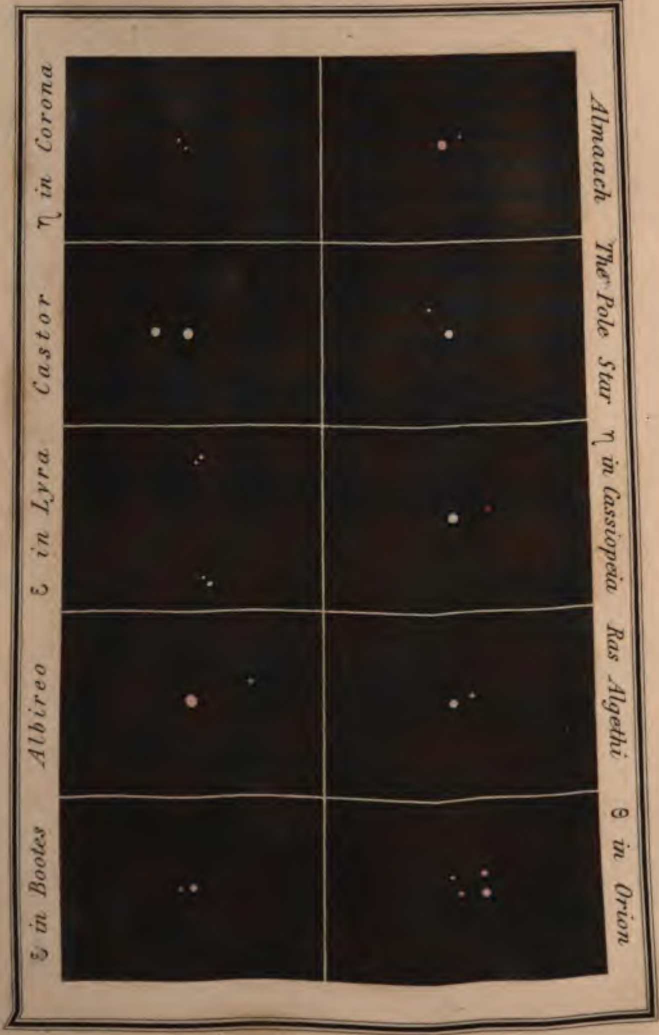
568.

DOUBLE AND QUADRUPLE

STARS

Pl. 1.



A COMPANION

TO THE

CELESTIAL ATLAS;

CONTAINING A SERIES OF

LESSONS ON THE CONSTELLATIONS,

A

DISSERTATION ON THE FIXED STARS,

AND

CONVERSATIONS ON THE HEAVENS,

WITH

DESCRIPTIONS AND VIEWS OF

THE MOST REMARKABLE DOUBLE STARS AND NEBULÆ.

BY J. MIDDLETON,

TEACHER OF THE USE OF THE GLOBES AND ASTRONOMY,
AND AUTHOR OF THE CELESTIAL ATLAS.

NORWICH:
JARROLD AND SONS, LONDON STREET.
LONDON:
HAMILTON, ADAMS AND CO. PATERNOSTER ROW.
1842.

568.

PREFACE.

This publication, as its name denotes, is intended to be used with the author's Celestial Atlas; and, together, they are designed to communicate a knowledge of the fixed stars.

As the plan which he has adopted, differs entirely from any yet published, it will be desirable to give some directions for its use. The letters of the Greek Alphabet, must, of course, be learned perfectly, as by them, the stars in each constellation, are distinguished. The Introduction to the Constellations should next be studied, till the questions on page 5 can be readily answered. These questions are succeeded by the most important part of the plan, which consists of a series of lessons on the maps in the Atlas. All the stars in each lesson should be found, first, in the map on the right hand page, and then on the corresponding blank map opposite. These lessons should be learned very perfectly; and, as using knowledge is the best means of fixing it in the mind, it will be desirable to trace out those constellations in the heavens, which have already been learned from the Atlas.

In the prosecution of this object, the directions at the beginning of each constellation should be carefully attended to. It will also be needful to obtain a knowledge of the four cardinal points. This is easily done, by observing the Pole Star, a knowledge of which should be among the first acquisitions of the young astronomer, and from which the other points may easily be found.

As every lesson, as well as the notes, is entirely independent, it is of no importance with which of the maps the study is commenced. The author recommends, however, that as the constellations in No. 1 never set to us, and are therefore always visible, they should be studied first; the map corresponding with the season then present should come next, and afterwards, the others should be proceeded with in the regular order of the seasons.

The notes to each constellation should be carefully perused, especially those which describe the peculiar conformation and position of the stars, as they will be found of great advantage in tracing the constellations in the sky.

When some considerable progress has thus been made, the second part, containing a dissertation on the fixed stars, should be studied. For this purpose, several questions are inserted at the end of each chapter, to adapt it to the excellent method of interrogative instruction, now so generally pursued.

In a small work which the author published some years since, to be used with his diagrams, he gave directions for surveying the heavens; these are now thrown into the form of dialogues, and inserted in the latter part of the book, as they will be found useful and amusing to those who have made some proficiency in the science.

The author is not aware of the existence of any work in which the study of the fixed stars is reduced to a system, though its intimate connexion with geography, and especially with the use of the globes, renders such a work desirable. Indeed, the study of the heavens, and of the earth, may be conducted on a similar plan. The best method of teaching geography is by blank maps, such as those of the Abbé Gaultier; the pupil should first be taught to find the quarters of the world, then its kingdoms, provinces, cities, towns, &c. In a similar way the heavens are best studied by dividing them into three parts, viz. the zodiac, and the stars to the north and sonth of it. These are again divided into constellations, which correspond with the kingdoms on a map of the earth; stars of the first magnitude correspond with the principal cities; and those of the second with cities of inferior size, while stars of the third, fourth, and fifth sizes, are like the boroughs, towns, and villages of a country.

By pursuing the plan thus recommended, the author is fully assured, from his own experience, that a knowledge of the heavens is much sooner acquired than a knowledge of the earth; with this especial advantage, that in geography we only see the names of the places on the maps, and not the places themselves; whereas, in astronomy, we see the stars, not only upon the maps, but actually shining in the heavens, in all their beauty and splendour.

Norwich, *Oct.* 1842.

The Greek Alphabet.

α	Alpha.	ν	Nu.
β	Beta.	ξ	Xi.
γ	Gamma.	ο	Omicron.
δ	Delta.	ϖ	Pi.
ε	Epsilon.	ϱ	Rho.
ζ	Zeta.	σ	Sigma:
η	Eta.	τ	Tau.
θ	Theta.	υ	Upsilon:
ι	Iota.	φ	Phi.
κ	Kappa.	χ	Chi.
λ	Lambda.	ψ	Psi.
μ	Mu.	ω	Omega.

Pl. 2.

INTRODUCTION
TO
THE CONSTELLATIONS.

The bodies we usually denominate stars, are divided into fixed stars and planets; the former being known by their always remaining in the same relative position, and by a constant scintillation or twinkling; while the latter are continually changing their places, and shine with a steady uniform light.

The term fixed stars is to be understood in a comparative, and not in an absolute sense, it being certain that many, and probable that all, are in a state of motion, although too slow to be perceptible, unless by means of very delicate observations, continued during a long series of years.

This change is called their proper motion, to distinguish it from their apparent diurnal revolution, caused by the earth's motion on its axis.

The fixed stars, visible to the naked eye, are divided into six classes, according to their apparent magnitudes. The largest are called of the first magnitude, the next in size of the second, and so on to the sixth, which are the smallest that can usually be perceived without the aid of glasses.

Those minute objects called telescopic stars, however, are likewise arranged according to their apparent size, to about the sixteenth or seventeenth magnitudes. They are immensely numerous, some hundreds, in the brightest parts of the heavens, appearing in the field of view of a telescope at one time; and even with the most powerful instruments, which have yet been constructed, there are myriads only just perceptible; from which we are justified in concluding, that there are vast numbers, which no instrument has yet enabled us to behold.

There are about 20 of the first magnitude, 76 of the second, 220 of the third, and the remainder of the fourth, fifth and sixth, increasing in number as they diminish in size; the whole number visible to the naked eye being about 2000.

All the stars of the same class are not exactly of the same size, there being very little difference between a small star of the first magnitude and a large one of the second, &c.

In order more readily to distinguish the stars from each other, astronomers, in the infancy of this science, divided the heavens into groups, called constellations, which are supposed to be circumscribed by the outline of some figure or animal.

This invention is generally attributed to the Chaldeans. They were afterwards copied and their number increased, by the Greeks and other nations.

The principal stars in each constellation are marked with the small letters of the Greek alphabet, the largest star usually having an α attached to it, the next in size a β, &c. and when the Greek letters are all used, those of the English alphabet are employed. This plan was adopted by Bayer, about the year 1603.

The modern constellations, which have been formed since the time of Bayer, are not marked with Greek letters, but English: as, Psalterium Georgii, Monoceros, Leo Minor, &c. Another plan for distinguishing these bodies, was adopted by Flamstead, the astronomer royal, more than a century ago. This was to number all the stars visible to the naked eye in each constellation, commencing with those on the West.

Besides being distinguished in this way, many of the larger stars have proper names: as, Aldebaran, Rigel, &c. These are generally derived from the Arabic, but, in the lapse of ages, they have been so much altered and corrupted, that it is frequently very difficult to trace their origin.*

Owing to the annual motion of the earth, each star comes to the meridian, or any point in the heavens, nearly four minutes earlier every day, making a difference of almost half an hour in a week, or two hours in a month.

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* In the Philosophical Magazine for November, 1830, there is a paper on this subject, to which the student is referred.

QUESTIONS FOR EXAMINATION.

1. How are the bodies called stars divided?

2. How is a fixed star known from a planet?

3. Are any of those bodies called fixed stars in a state of motion?

4. Into how many magnitudes are the fixed stars, visible to the naked eye, divided?

5. What are those called which are invisible to the naked eye?

6. How many stars are there of the first magnitude?

7. How many of the second and third?

8. How many are visible to the naked eye?

9. Are all the stars, which are called of the first magnitude, of the same apparent size?

10. What is a constellation?

11. Who are supposed to have first divided the heavens into constellations?

12. By whom were they copied?

13. How are the principal stars in each marked?

14. Who marked the stars with the Greek letters?

15. How do we know the modern, from the ancient constellations?

16. What plan did Flamstead adopt?

17. From what language were many of the names of the fixed stars derived?

18. What is the daily difference in time of any star's coming to the meridian?

19. To what is this difference owing?

20. How much earlier will any constellation be in a given part of the heavens in a week and month?

LESSONS

ON

THE CONSTELLATIONS.

MAP I.

UR'SA MA'JOR.

NINE IN THE EVENING.

SPRING—NEAR THE ZENITH.
SUMMER—N. W.
AUTUMN—N.
WINTER—N. E.

α Dub'he, and *β* the Pointers.
γ δ on the back.
ε A'lioth, *ζ* Mi'zor, *g* Al'cor, and
η Ben'etnasch, on the tail.
ι κ, *λ μ*, *ν ξ*, on the feet.
θ on the leg.
f on the foot.
h. *v*. on the neck.

ο on the nose.
χ ψ ω on the hind leg.
ϱ σ on the ear.

Ursa Major is easily distinguished in the heavens by the peculiar conformation of seven brilliant stars, four of which are on its body, and three in the tail.

The places of three of its feet are determined by three pairs of stars, at equal distances, and nearly in a right line. The two stars in its fore foot are midway between the Pointers and the bright stars in the heads of Gemini.

As only the extremity of one of the hind legs of this large constellation sets to the British Isles, it always makes a very splendid appearance in our Northern latitudes.

The bright stars α and β are called the Pointers, because they direct the eye to the pole star in the extremity of the tail of Ursa Minor.

The word Alioth, in Arabic, denotes a horse, and the Arabians probably gave this name to each of the three bright stars in the tail of Ursa Major, as they are placed like three horses, thus arranged for the purpose of drawing the waggon, commonly called "Charles's Wain," represented by the four large stars on the body of the same constellation.

ξ in the hind foot is a very remarkable and interesting binary or double star; the two bodies of which it is composed, are extremely close, and require a very excellent telescope to separate them; they are found to revolve about one another in regular orbits, and complete one revolution in $58\frac{1}{4}$ years.

Between the head of Asterion and Benetnasch, is a faint nebula. (Plate 3rd, Figure 3rd.)

ζ in the tail is a double star, considerably unequal, distance 14″

UR'SA MI'NOR.

ALWAYS NORTH.

α Alruc'cabah, the pole star.
β Ko'chab, and γ on the shoulder.
δ ε on the tail.
ζ η θ κ on the hind leg.
τ in the nose.

The Pole Star is very nearly in a line with the Pointers in Ursa Major, and about three times as far to the north of them, as they are from each other. δ ε in the tail, and ζ on the body of Ursa Minor, with Kochab and Alruccabah, are at nearly equal distances from each other; and form a curve, one of the bright stars being at each extremity.

The true North Pole does not coincide with Alruccabah, but is 1° 24′ from that star, in the direction of Alioth, in Ursa Major. The Pole Star is double, but the smaller one is so very minute that it requires a high magnifying power to render it visible.

DRA'CO.

NINE IN THE EVENING.

Spring—N. E.
Summer—near the zenith.
Autumn—N. W.
Winter—N.

α on the fifth fold.
β Ras'taban, and γ Et'anin in the head.
δ ε on the second fold.
ζ η θ ι on the third and fourth folds.
κ λ on the sixth fold.
μ ν ξ on the head.
The nine stars in the first fold.

The head of Draco may be found by the two bright stars, Rastaban and Etanin; and the tail between Ursa Major and Ursa Minor. α in Draco is nearly midway, and in a line between Kochab and Benetnasch.

ζ in Draco is between the head of that constellation and the body of Ursa Minor.

β γ ξ in Draco, and ι in the foot of Hercules, are in the form of a diamond.

γ in Draco passes exactly over London.

4640 years ago α in Draco was the Pole Star. This change is owing to a small annual alteration in the position of the earth's axis, which likewise causes the precession of the Equinoxes.

Double stars *ν ο ψ μ h ε b.*

CE'PHEUS.

NINE IN THE EVENING.

SPRING—N.
SUMMER—N. E.
AUTUMN—NEAR THE ZENITH.
WINTER—N. W.

α Aldera'min in the shoulder.
β in the girdle.
δ ε ζ in the head.
ξ in the chin.
η θ in the right elbow.
ι ο ψ in the left arm.
γ κ near the knees.
ω μ in the feet.

A line drawn through *α* Shedir and *β* in Cassiopeia will direct us to *α* Alderamin, in the shoulder of Cepheus. His head is nearly in a line with Deneb, *γ* and Albireo in Cygnus.

α and *β* in this constellation will also serve as Pointers to the Pole Star.

Cepheus may be found by its position, opposite the tail of Ursa Minor, and between Draco and Cassiopeia.

The head of Cepheus, with α β and ι form a diamond, in the centre of which we find ξ in the chin.

δ in the head of Cepheus is double, one of its component stars being much larger than the other.

It was likewise discovered by Goodricke, in 1784, to be subject to a periodical variation in its lustre, changing from the third or fourth, to the fifth magnitude, and back again in five days, eight hours, and thirty-seven minutes.

Other double stars, β ξ.

CASSIOPE'IA.

NINE IN THE EVENING.

Spring—N. W.
Summer—N.
Autumn—N. E.
Winter—near the zenith.

α She'dir in the breast.
β γ δ ε
η between She'dir and γ.
θ μ in the elbow.
ζ λ in the chin.

Cassiopeia is on the opposite side of the Pole Star to the Great Bear, and at the same distance from it. This constellation may be known from its five principal stars, forming a W.

η is a double star very unequal in size, distance 11″, and exhibits the beautiful combination of a large white star, and a small one of a rich ruddy purple.

In the year 1572, Tycho Brahe discovered a new star in Cassiopeia, very near κ, which shone with more light than Venus, till 1574, when it disappeared entirely.

μ has an annual proper motion of $3\frac{3}{4}''$.

PER'SEUS.

NINE IN THE EVENING.

Spring—W.
Summer—N.
Autumn—E.
Winter—near the zenith.

α Al'genib, in the side.
γ θ in the shoulders.
ι in the breastplate.
η in the helmet.
χ in the hand.
δ in the side.
λ μ in the knee.

ε ξ ζ ο in the leg.

β Al′gol, in the head of Medu′sa.

Perseus may be distinguished by Algenib, γ and δ being in a line slightly curved, his position in the Milky Way, and by his lower leg being North of the Pleiades.

A line drawn from Algenib to δ in Cassiopeia, passes through the sword handle of Perseus, which contains a very interesting nebula. It is in the Milky Way, and visible to the naked eye. When viewed through a telescope, it is found to contain an amazing number of small stars, all within the space of a few minutes, and is a very rich and beautiful object.

Algol is a variable star. It changes from the 2nd to about the 4th magnitude in 3½ hours, and during the next three hours and a half gradually recovers its greatest brightness, it then continues of the 2nd magnitude for 2 days, 13 hours, when it again begins to decline. The best method of observing this alteration, is by comparing it with ρ to the south of it.

Double stars, A. η. ε.

MISCELLANEOUS.

a b c in Mus′ca.

γ Al′maach. ξ φ in Androm′eda.

ι κ λ in Glo′ria Frederi′ci.

c g d e b in Lacer'ta.
α De'neb, in Cyg'nus.
γ δ θ in ditto.
ι η σ τ in Her'cules.
Gem'ma, in Coro'na Borea'lis.
β in the face of Boo'tes.
γ δ in the shoulders.
ε Mi'rac. ϱ σ in the girdle.
λ in the arm.
θ ι κ in the hand.
Cor Car'oli.
b d e in the head of Lynx.
p r near the tail.
α Capel'la, and β in the shoulders of Auri'ga.
δ ε ζ η in ditto.
P N O in the head of Camel'opard.

No part of Draco, Ursa Minor, Cepheus, or Cassiopeia ever sets to the British Isles.

The modern constellation Camelopard, contains no stars larger than of the 4th magnitude; its body is between the Great Bear's head and Perseus, and its head between the tail of Draco and the Pole Star.

Tarandus and Custos Messium are small unimportant constellations, between the Pole Star and Cassiopeia.

QUESTIONS FOR EXAMINATION ON

PLATE I.

1. Which are the Pointers?

2. What is the meaning of A′lioth?

3. Point out the following stars:—Ras′taban, Et′anin Dub′he, Ben′etnasch, Mi′zor, A′lioth, Al′cor, Capel′la, De′neb, Aldera′min, the Pole Star, Ko′chab, Al′genib, Al′gol, Gem′ma, Al′maach, and She′dir.

4. Which is the double star in the foot of Ur′sa Ma′jor, and what is the time in which its two stars complete one revolution?

5. What letter is formed by the five principal stars in Cassiope′ia?

6. What is the rule for finding α in Draco?

7. Mention the variations to which Al′gol is subject?

8. How far is Alruc′cabah from being over the North Pole?

9. Point out the six stars in the feet of Ur′sa Ma′jor.

10. Which is Cor Car′oli?

11. What two stars point out Aldera′min?

12. What constellations never set to the British Isles?

13. Point out and describe the nebula in the sword handle of Per′seus.

14. What constellation is on the opposite side of the pole to Ur′sa Ma′jor?

15. What star in Dra′co passes exactly over London?

16. Why are α and β in Ur′sa Ma′jor called the Pointers?

17. What is the rule for finding the two stars in the fore foot of Ur′sa Ma′jor?

18. Which two stars of the third magnitude in Ce′pheus point to the Pole Star?

19. Point out *h v* in the neck and *o* in the nose of Ur′sa Ma′jor.

20. How long is it since α in Dra′co was the Pole Star, and what is the cause of the change which has taken place?

21. Describe the star which appeared in Cassiope′ia, in 1572.

WINTER.

MAP II.

ANDROM′EDA.

EIGHT IN THE EVENING.

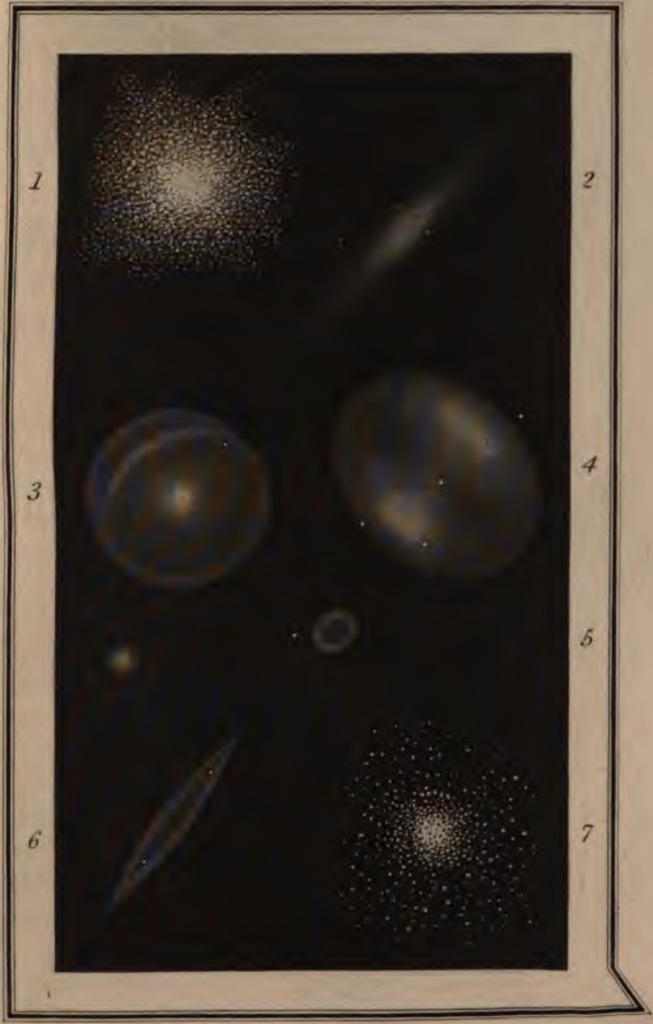
September, October—E.
November, December—S. E. S.
January, February—S. W. W.
March, April—N. W.

α Al′pharetz in the head.
β Mi′rach in the girdle.
γ Al′maach in the foot.
δ ε π in the breast.
ζ η in the left arm.
θ ϱ σ in the right arm.
B in the hand.
μ ν in the garment.
φ in the right foot.
τ υ in the leg.

SERIE 6

NEBULÆ

Pl. 3.



Andromeda may be easily found in the heavens by her three principal stars, at equal distances from each other, and nearly in a right line. In our latitude, in consequence of their lying obliquely across the meridian, they rise horizontally, and set perpendicularly.

When in the East, Andromeda is seen directly over Aries.

γ is a double star, very unequal in size: the large, reddish white; the small, fine light sky blue, inclining to green, distance 9″. "A most beautiful object."—*Dr. Herschel.*

"Near ν in this constellation, is a nebula, (Plate 3, fig. 2.) visible to the naked eye, which is continually mistaken for a comet, by those unacquainted with the heavens. Its appearance has been compared to that of a candle, shining through horn; its form is a pretty long oval, increasing by insensible gradations of brightness, at first very gradually, but afterwards more rapidly, up to a central point, which, though very much brighter than the rest, is evidently not stellar, but only nebula in a high state of condensation. It has in it a few small stars, but they are obviously casual, and the nebula itself offers not the slightest appearance, to give ground for supposing that it consists of stars. It is very large, being nearly half a degree long, and 15 or 20 minutes broad."—*Sir J. Herschel.*

Between Almaach and Algol, but much nearer the former, is a very curious, but faint nebula, (Plate 3, fig. 6.)

GLO'RIA FREDERI'CI.

ι κ λ Ψ on the sword handle.
ο on the branch.

This asterism has been placed among the constellations by Monsieur Bode, in memory of Frederic II. King of Prussia. The stars of which it is composed formerly belonged to Andromeda.

PIS'CES.

SEVEN IN THE EVENING.

October, November—S. E.
December—S.
January, February—S. W.

α in the bow of the ribbon.
ο π η ϱ in the northern ribbon.
ξ υ μ ζ ε δ in the southern ribbon.
Ψ Φ ι τ in the northern fish.

Pisces contains no stars greater than of the 3rd magnitude, and the only one of that size, is α, in the bow of the ribbon, on the neck of Cetus.

The northern fish is situated under the arm of Andromeda. Two lines of small stars may be seen connecting each of the fish with α, in the neck of Cetus.

The southern fish is represented by seven distinct stars, like an ellipse, under the centre of the large square, formed by the three bright stars in Pegasus and Alpheratz in Andromeda. (Vide Map 5.)

ζ and the first Ψ are double stars.

A′RIES.

SEVEN IN THE EVENING.

October, November—E. and S. E.
December, January, S. E. S. and S. W.
February, March—S. W. and W.

α Arie′tis in the following horn.
β γ Mesar′thim in the leading horn.
δ ε ζ in the back.
α β γ in Trian′gulum.
a b c in Mus′ca.

Aries is found in the heavens by the three bright stars in his horns of the 2nd, 3rd, and 4th magnitudes; the only other stars of note are δ ε ζ, forming a cluster on the back, in a line with Arietis and Aldebaran.

Mesarthim is a double star, equal, distance 10″, as is likewise, a small star over the Ram's back.

Triangulum is directly to the North of the head of Aries. Musca, over his back, is midway between Triangulum and the Pleiades.

CE′TUS.

SEVEN IN THE EVENING.

November, December—S. E. S.
January, February—S. S. W.

α Men′kar, in the jaw.
γ δ in the mouth.
ο Mi′ra, in the neck.
λ μ ξ ω in the head.
ν in the eye.
ζ Ba′ten Kai′tos θ η τ on the body.
β De′neb Kai′tos ι in the tail.
ε π ϱ σ in the chest.

Cetus, though one of the largest constellations, contains comparatively few stars. The only clusters, by which it is characterized, are an irregular quadrilateral on its body, made by four stars of the third magnitude; and that in the head, of which Menkar λ μ ξ ω and α in Pisces, form the outline.

The head of Cetus is directly south of Aries.

Mira is one of the most remarkable of the variable stars. It was first noticed by Fabricius in 1596. It goes through its different degrees of brightness or one revolution, in a period of 334 days; remaining at its greatest brightness about a fortnight, being then, on some occasions, equal to a star of the 2nd magnitude; decreases about 3 months, till it becomes completely invisible; in which state it remains about five months; when it again becomes visible, and continues increasing during the remaining three months of its period. Such is the general course of its phases. It does not always, however, return to the same degree of brightness, nor increase and diminish by the same gradations. Havelius indeed relates, that during the four years between October, 1672, and December, 1676, it did not appear at all. *(Sir John Herschel.)* On account of its extraordinary changes, it has been called Mira, or the Wonderful Star. Its place in the heavens may be found by remembering that Menkar δ and Mira are in a right line, and at equal distances from each other, Menkar being at one extremity of the line, and Mira at the other; Mira is a double star, very unequal.

There is likewise a double star near Mira, which is a very pretty object.

As Mira, β in Lyra, δ in Cepheus, and perhaps some other variable stars, are double, it would be well if those who are in possession of very superior glasses would observe, whether the two stars maintain the same relative apparent sizes in all the stages of increase and decrease of lustre.

PER'SEUS.

NINE IN THE EVENING.

SPRING—W.
SUMMER—N.
AUTUMN—E.
WINTER—NEAR THE ZENITH.

α Al'genib in the side.
β Al'gol, and ϱ in the head of Medu'sa.
γ θ in the shoulders of Per'seus.
ι in the breastplate.
δ in the side.
λ μ in the knee.
ε ξ ζ ο in the leg.

For notes on Perseus, see page 14, Map 1.

TAU'RUS.

SEVEN IN THE EVENING.

NOVEMBER AND DECEMBER—E. and S. E.
JANUARY AND FEBRUARY—S. E. S. and S. W.
MARCH AND APRIL—S. W. and W.

α Aldeb'aran, the Bull's Eye.
θ γ δ ε in the Hy'ades.
The Plei'ades.
β ζ at the ends of the horns.

ι κ χ in the ear.
λ in the chest.
μ *d* in the knees.
ο near the horn of Ce′tus.

The Pleiades, or Seven Stars, in the neck of Taurus, so conspicuous during our winter months, will render it very easy to discover that constellation.

It likewise contains another very beautiful cluster, called the Hyades, the largest star in which, Aldebaran, of a reddish hue, is usually termed the Bull's Eye.

The principal stars in the Hyades, resemble a V, Aldebaran and ε being at the top, and γ at the bottom.

The foot of Auriga is placed upon the extremity of the upper horn of Taurus.

Double stars τ φ χ κ *d*.

FLU′VIUS ERIDA′NUS.

SEVEN IN THE EVENING.

December, January—S. E.
February—S.
March, April—S. W.

Point out β λ μ ν ξ γ δ ε ζ η υ.
Psalte′rium Geor′gii.
n p r in Scep′trum Brandenbur′gium.

The Eridanus, to the South of Taurus, flows from Orion to Cetus, whence it returns and descends below our horizon; its principal stars are γ midway between Rigel and the chest of Cetus, δ ε ζ η in a horizontal line, to the West of γ, and β and λ near Rigel.

Eridanus is the classical name of the River Po in Italy. It is sometimes called Fluvius Orionis.

Psalterium Georgii is a new constellation, introduced by one of the German astronomers, in honour of his Britannic Majesty, George the Third.

AURI'GA.

NINE IN THE EVENING.

January, February—S. E. and S. NEAR THE ZENITH.
March, April—S. W. and W.
May, June—W. and N. W.
July, August—N. W. and N.
September, October—N. E.
November, December—N. E. and E.

Capel'la and β in the shoulders.
θ in the hand.
κ in the bridle.
ι in the foot.

ε ζ η forming a triangle near Capel′la.

δ in the cap.

Capella and β in the shoulders of Auriga are both at the same distance from β in the north horn of Taurus, which is thought to have been formerly called γ in Auriga.

This constellation may likewise be known by three bright stars of the 4th magnitude, forming a triangle in the kids near Capella.

θ in the hand, κ in the bridle, and θ in Gemini, form a V.

Capella never sets to the British Isles.

Camelopard extends from Auriga to the Pole.

ORI′ON.

SEVEN IN THE EVENING.

November, December—E. and S. E.
January, February—S. E. and S.
March, April, S. W. and W.

α Be′telgeuse and γ Bella′trix, in the shoulders.

δ ε ζ in the belt.

β Ri′gel in the foot.

κ in the knee.

η θ ι in the sword.

λ φ in the face.
μ in the arm.
ν in the hand.
χ in the club.
ο π ξ in the lion's skin.

Orion, the most brilliant of the constellations, is familiar to most persons, from the three bright stars of the 2nd magnitude, at equal distances, and in a right line, which mark his belt. N. E. of this belt in his right shoulder is Betelgeuse, a fiery looking star of the 1st magnitude, and at an equal distance on the opposite side of it, we find Rigel, a beautiful white star. Bellatrix in the left shoulder, and κ in the knee, are likewise on opposite sides, and at equal distances from the belt.

The stars in the lion's skin are between Taurus and Orion, and in our latitude, always rise before the other parts of the constellation.

Near θ in the sword, is the most remarkable nebulous spot in the heavens. With a telescope, several stars may be discovered in it, which appear to shine through a lucid cloud, very bright near the middle, but faint and ill-defined about the edges. It looks like a gap in the sky, through which we catch a glimpse of a much brighter region.

Rigel, in the language of the East, signifies a foot.

Double stars θ ζ δ τ σ β λ.

LE'PUS.

SEVEN IN THE EVENING.

December, January—S. E. and S.
February, March—S. and S. W.

α β ζ η on the back.
ι κ λ ν in the ears.
γ δ in the hind feet.
ε in the fore foot.

Lepus is directly South of Orion; the four small stars in its ears are immediately under Rigel.

ξ η α β on its back, are in a line slightly curved.

Only part of Columba Noachi is ever visible in our latitude. It is on the same meridian as Orion.

MISCELLANEOUS.

κ λ μ in Colum'ba No'achi.
η μ ν γ ξ in Gem'ini.
β ζ in Ca'nis Ma'jor.
Al'genib in Peg'asus.
θ μ ζ λ in Cassiope'ia.

QUESTIONS FOR EXAMINATION ON MAP II.

1. Point out the following stars:—Al'pharetz, Mi'rach, Al'maach, Al'genib, Al'gol, Capel'la, Aldeb'aran, Arie'tis, Men'kar, Be'telgeuse, Bella'trix, Ri'gel.

2. Which are δ ε ζ on the back of A'ries?

3. In what position do the three bright stars in Androm'eda rise and set?

4. Can the whole of Colum'ba No'achi be seen in England?

5. Near what star is the nebula in Androm'eda?

6. What letter is formed by the principal stars in the Hy'ades?

6. Point out β and ζ in the horns of Tau'rus, α β γ in Trian'gulum, De'neb Kai'tos, Ba'ten Kai'tos, *n p r* in Scep'trum Brandenbur'gium, μ ν in the girdle of Androm'eda, and α in Pis'ces.

7. What constellation is directly North of the head of A'ries?

8. What constellation is directly South of A'ries?

9. Point out the variable star in the neck of Ce′tus, and describe its variations.

10. What is the modern name of the Erida′nus?

11. Point out and describe the nebula in the sword of Ori′on.

12. What is the meaning of Ri′gel in the language of the East?

11. Point out the course of the Eclip′tic.

12. Is Le′pus in the Northern, or Southern hemisphere?

13. To what constellation did the stars in Glo′ria Frederi′ci, formerly belong?

14. On what does the foot of Auri′ga rest?

15. In which hemisphere is Men′kar?

16. In what month is A′ries seen best?

17. In what part of the sky is Auri′ga seen in the evenings of January?

18. What stars are directly over the Plei′ades?

19. What constellation is directly South of Ori′on?

20. Which is the beautiful double star in Androm′eda?

SPRING.

MAP III.

GEM'INI.

EIGHT IN THE EVENING.

November, December—N. E.
January, February—E. and S. E.
March, April—S. and S. W.
May, June—W. and N. W.

α Cas'tor, β Pol'lux.
δ θ in the arms of Cas'tor.
ε ζ in the knees.
η μ ν γ ξ in the feet.
κ λ in the club of Pol'lux.

Gemini may be distinguished by the bright stars Castor and Pollux, to which the fore foot of Ursa Major always points; and the four in a right line in the feet.

ε and ζ in the knees, and λ in the club, are at nearly equal distances from each other, and likewise in a right line.

Castor and Pollux rise perpendicularly in our latitude.

Castor is a fine double star, rather unequal, distance 5″; the two stars of which it is composed, are found to circle mutually round each other or rather round the common centre of gravity between them. The period of one complete revolution has been estimated at rather more than 250 years.

η in the toe of Castor is very near the first degree of Cancer in the Ecliptic, which is the Sun's place on the longest day.

Double stars. One near γ towards ζ in Taurus, ζ β.

* * *

AURI'GA.

NINE IN THE EVENING.

JANUARY, FEBRUARY—S. E. and S. NEAR THE ZENITH.
MARCH, APRIL—S. W. and W.
MAY, JUNE—W. and N. W.
JULY, AUGUST—N. W. and N.
SEPTEMBER, OCTOBER—N. E.
NOVEMBER, DECEMBER—N. E. and E.

α Capel'la, and β in the shoulders.
θ in the hand.
κ in the bridle.
ε ζ η near the kids.

For notes on Auriga, see page 27.

CA'NIS MA'JOR.

EIGHT IN THE EVENING.

JANUARY, FEBRUARY—S. E. and S.
MARCH, APRIL—S. and S. W.

α Si'rius, the dog star.
β ζ λ in the feet.
δ σ ε on the body.
η near the tail.
1st and 2nd ο on the shoulder.
γ in the neck.

Sirius, the brightest and therefore supposed to be the nearest of the fixed stars, may be observed in the evenings of the Winter and early Spring months, towards the South, shining with a clear white light. To the right of it is β of the second magnitude.

"Dr. Wollaston by direct photometrical experiments, open as it would seem to no objections, ascertained that the light received by us from the Sun, was twenty millions of times as much as that we derive from Sirius." *Sir J. Herschel.*

MONO'CEROS, AND CA'NIS MI'NOR.

EIGHT IN THE EVENING.

JANUARY, FEBRUARY—S. E.
MARCH—S.
APRIL, MAY—S. W.

h i g e b in the head.
d a in the fore feet.
p q on the back.
α Proc′yon and *β* in Ca′nis Mi′nor.

The modern constellation Monoceros is between Canis Major and Canis Minor, and contains no stars of considerable magnitude.

Double and multiple stars. *e* near the mouth, *b* in the nose, *h* in the ear, a star over the right fore foot, and another in the left fore foot.

Canis Minor, known by Procyon of the 1st magnitude and *β* of the 3rd, may be easily found by its position to the South of Gemini.

CAN′CER.

EIGHT IN THE EVENING.

JANUARY, FEBRUARY—E. and S. E.
MARCH, APRIL—S. E. S. and S. W.
MAY, JUNE—S. W. and W.

α β in the claws.
γ Asel′lus Bo′reas.
δ Asel′lus Austra′lis.
Prœ′sepe the manger.
ζ θ.

TELESCOPIC

VIEWS.

Pl. 4

The Pleiades

Præsepe

LE′O MI′NOR.

EIGHT IN THE EVENING.

FEBRUARY—N. E.
MARCH—E.
APRIL—S.
MAY—W.
JUNE—N. W.

i f h l on the body.
a b c in the feet.
p r in the tail.

Leo Minor is between Ursa Major and Leo, and between the hind feet of the former.

* * *

LE′O.

NINE IN THE EVENING.

FEBRUARY, MARCH—E. and S. E.
APRIL, MAY—S. E. S. and S. W.
JUNE, JULY—S. W. and W.

α Re′gulus, or Cor Leo′nis.
η γ ζ in the neck.
κ λ ε μ in the head.
δ *h* on the back.

θ ι on the thigh.
ο ξ in the fore legs.
β Deneb′ola.

The peculiar configuration of the stars in Leo, renders it easily distinguishable in the heavens. Regulus, and the three bright stars to the North of it, are in a zigzag line; to the right of which, but rather higher, are the four stars on the head.

δ θ and ι are in a line, slightly curved.

γ in the neck is a double star, very unequal in size. Its two component orbs, it is estimated, occupy 1200 years, in making one revolution.

CRATER AND CORVUS.

NINE IN THE EVENING.

April, May—S. E. and S.
June, July—S. and S. W.

α Al′kes, and β in the foot.
γ δ ε κ ι η ζ θ in Cra′ter.

COR′VUS.

α ε in the head.
δ Al′gorab, and γ in the wings.
β in the foot.

Crater contains no stars larger than the third magnitude. It is best seen in the south, during the evenings of April and May, when with a little care, its outline may be traced.

MISCELLANEOUS.

β η in Vir′go.
Co′ma Bereni′ces.
Cor Car′oli.
d in Ca′nes Venat′ici.
η Ben′etnasch γ θ χ Ψ ω in Ur′sa Ma′jor.
ι κ, λ μ, ν ξ in the feet.
p r in the tail of Lynx.
β ζ in the horns of Tau′rus.
Be′telgeuse.
η ζ γ δ in Le′pus.
α in Colum′ba No′achi.
h k in Sex′tans Ura′niœ.
ι κ Mar′kab in Ar′go Na′vis.

Only part of Argo Navis, and that containing no stars of considerable magnitude, rises in our latitude.

QUESTIONS FOR EXAMINATION ON

MAP III.

1. Point out Si'rius, Capel'la, Cas'tor, Pol'lux, Proc'yon, Asel'lus Bo'reas, Asel'lus Austra'lis, Cor Hy'dra, Re'gulus, Deneb'ola, Cor Car'oli, and Al'gorab.

2. Between what constellations in the Zodiac is Can'cer?

3. What constellation is between Ca'nis Ma'jor and Ca'nis Mi'nor?

4. In what position do Cas'tor and Pol'lux rise?

5. What are the best months for observing Cra'ter?

6. Point out the double star in the neck of Le'o, and mention how long it is in making one revolution.

7. Which is a double star, Cas'tor, or Pol'lux? Point it out.

8. Which are the four stars in the head of Le'o?

9. Point out ε and ζ in the knees of Gem'ini, and η near the toe of Cas'tor.

10. Why is Si′rius supposed to be the nearest of the fixed stars, and what colour is it?

11. How much more light does Dr. Wollaston say we receive from the Sun, than from Si′rius?

12. How may Proc′yon be found?

13. Which are the stars in the head and fold of Hy′dra?

14. What is the rule for finding α in Can′cer?

15. Point out Prœ′sepe, and describe it.

16. Which is the multiple star in the head of Monoc′eros?

17. Point out Re′gulus, η γ and ζ in Le′o.

18. Which are the three pair of stars in the feet of Ur′sa Ma′jor?

19. How is Le′o Mi′nor situated?

20. What two constellations stand upon Hy′dra?

21. During what months may Si′rius be seen best?

22. What constellation is the head of Hy′dra directed towards?

SUMMER.

MAP IV.

VIR′GO.

NINE IN THE EVENING.

April, May—S. E. and S.
June, July—-S. and S. W.

α Spi′ca, ε Vindemia′trix, in the arm.
γ δ ζ θ in the robe.
η in the shoulder, β in the wing.
1st and 2nd ξ and ν in the head.
ο in the chin.
κ λ μ in the feet.
Z Φ ι in the robe.

Four stars, γ δ ζ and θ in the robe, with Spica to the South, and Vindemiatrix to the North of them, will sufficiently point out this interesting constellation. Besides which, we may observe, that Vindemiatrix is at an equal distance from Arcturus and Denebola, and rather lower than a right line drawn between them.

β in the wing, is under Denebola.

γ is a double star, remarkable for the length of its period, the rapid increase in angular motion of the two stars of which it is formed, and particularly the great diminution of their apparent distance. It has been known to be double for at least 120 years. The two stars, which are nearly equal, were so far apart about the middle of the last century, that they were marked in Mayer's catalogue as two distinct stars, so that any moderately good telescope would have shewn their separation, being at that period, about 7″ from each other. Since that time, they have been constantly approaching, and in 1833 were scarcely more than a single second asunder, so that even telescopes of very superior power could not shew them otherwise than as a single star somewhat elongated. From a great number of observations the above-mentioned facts have been ascertained; and it has been inferred that the plane of the orbit in which these two bodies move, is nearly parallel to our line of vision, and the period of their revolution about 629 years.

Spica signifies an ear of corn; Vindemiatrix, a female vintager, or one who gathers grapes; both which terms seem to have a reference to the season when the sun is in this sign, for it appears, from the precession of the equinoxes, that when the signs of the Zodiac were first formed, Virgo occupied that part of the ecliptic through which the Sun passes in September, a month distinguished in the countries where astronomy was first studied, by the harvest both of corn and grapes.

CO'MA BERENI'CES AND COR'VUS.

NINE IN THE EVENING.

April, May—E. S. E. and S.
June, July—S. S. W. and W.

a b c d e f in Co'ma Bereni'ces.

COR'VUS.

α ϵ in the head.
β in the foot.
δ γ in the wings.

Coma Berenices consists of several stars of the 4th and 5th magnitudes, somewhat in the form of a pyramid; besides a great number of nebulæ, which are visible only by the aid of telescopes.

Corvus may be known by four bright stars in the wings, foot, and head, forming a square; the right corner on the top of which is a little flattened.

BOO'TES.

NINE IN THE EVENING.

February, March—N. E.
April, May—E. and S. E.
June—S.
July, August—S. W. and W.
September, October—N. W.

α Arctu'rus η in the leg.
ε Mi'rach ϱ σ in the girdle.
γ δ in the shoulders.
β in the face.
λ in the arm.
θ ι κ in the hand.
μ Alkatu'rops in the top of the spear.
Ψ ω *c* in the right hand.
ξ ο π ζ in the leg.
Cor Car'oli.
c d in Ca'nes Venat'ici.

Bootes may be discovered by observing the following directions.

If the curve, formed by Alioth, Mizor, and Benetnasch, be continued downward, it will point out Arcturus, which, with Mirach in the girdle, and δ in the shoulder, are at equal distances and in a right line.

θ ι κ in the hand with the leash, are near Benetnasch.

Arcturus is a fine star of a golden colour, and the brightest in the Northern hemisphere.

Mirach is a very beautiful double star. It presents an appearance somewhat similar to a planet and its satellite, both shining with innate, but differently coloured light. The small star is of a blueish colour, and is separated from the other by a space equal to the diameter of the larger star, and its apparent size is one third of the other. The large star has a reddish tinge. It requires a very excellent and powerful telescope to see this star double. (Vide plate 1.)

Nearly in the centre of a right line drawn from Cor Caroli to Benetnasch, but rather nearer to the latter star, and just under the collar of Asterion, is a very remarkable nebula, it consists of a bright round nucleus or central part, surrounded at a great distance by a nebulous ring, which appears split through the greater part of its circumference. It has never been resolved into stars by the highest powers that have yet been applied; it is a very dim faint object, and requires a large glass to discover it. (Vide plate 3, fig. 3.)

Arcturus is found to have a motion among the other stars, amounting to 1″ 72 annually.

The word Bootes is derived from a Greek word, signifying a waggoner, ploughman, or herdsman, and seems to have been applied to this constellation from its attending and seeming to urge on Ursa Major; the seven principal stars in which are thought to bear some resemblance to a wain or waggon, drawn by horses or oxen.

Cor Caroli or Charles's Heart, was so called in honour of King Charles 1st.

Double stars μ δ ι κ π ξ *i*.

LI'BRA.

TEN IN THE EVENING.

MAY, JUNE—S. E. and S.
JULY, AUGUST—S. and S. W.

α Zu'ben el Genu'bi in the Southern scale.
β Zu'ben el Chima'li in the Northern scale.
γ Zu'ben el Ak'rab.
δ ε γ ι.

Libra is known by the two stars α and β of the 2nd magnitude, to the S. E. of Virgo.

Double stars α and ξ.

SCOR'PIO.

TEN IN THE EVENING.

JUNE, S. E. and S.
JULY—S. and S. W.

α Anta'res.
β δ in the head.
π ϱ in the claws.
σ τ near Anta'res.

Scorpio lies to the South of Ophiuchus, whose left foot is placed on it. It is distinguished by Antares of the 1st magnitude, which shines with a deep red light; and its head is marked by β, which with δ π and ρ form a line slightly curved in a direction from North to South.

Several stars in the tail of Scorpio are so far South as not to rise in our latitude.

Double stars β ν in the head.

CORO'NA BOREA'LIS·

TEN IN THE EVENING.

April, May, June—N. E. and E.
July, August—S.
September, October, November—W. and N. W.

α Gem'ma vel Alphec'ca.
β γ δ ε ζ η θ ι.

Corona Borealis is between Hercules and Bootes, and is easily found by its five principal stars forming a crescent.

σ in Corona is a double star, whose period is 287 years.

η is likewise a double star, which requires a glass of the very first excellence to separate. Its period is 42 years. (Vide plate 1.)

ν υ ζ are double stars.

HER'CULES.

TEN IN THE EVENING.

APRIL, MAY, JUNE—N. E. and E.
JULY, AUGUST—S.
SEPTEMBER, OCTOBER, NOVEMBER—W. and N. W.

α Ras Al'gethi, in the head.
β γ ϰ Mar'sic in the right arm.
δ in the breast.
a λ Maa'sym μ ξ and ο in the left arm.
ε ζ in the side.
π ϱ θ ι in the left leg and foot.
η σ τ υ and *g* in the right leg.
k *i* near the club.
Cer'berus et Ra'mus Pom'ifer.

The large constellation, Hercules, is situated between Corona and Lyra, having Draco on the North, and Ophiuchus on the South.

Ras Algothi in the head of Hercules, and Ras Alhague in the head of Ophiuchus, are only five degrees apart.

The arms are shewn by a line of stars, stretching across the constellation from the head of Serpens to the centre of Lyra.

The place of the right leg is marked by five stars, forming a cone, the base of which is toward the North.

Between the head of Draco and Cerberus are ι and θ, the former in the left foot, and the latter in the knee.

ζ in Hercules, is a remarkable instance of a double star, whose orbit is very nearly, if not exactly parallel with our line of vision, in which, therefore, one of the stars passes in front of the other; when they exhibit merely the appearance of a single star.

Ras Algothi is a double star, very unequal in size, distance 4″.

Between ζ and η is a very interesting nebula, just discernible with the naked eye. (Vide plate 3, fig. 1.)

Double stars γ δ κ ρ.

* * *

OPHI'UCHUS.

TEN IN THE EVENING.

June, July—S. E. and S.
August, September—S. and S. W.

α Ras Alha'gue, in the head.

β γ ι κ in the shoulders.

λ in the left arm.

δ marked Yed, and ε in the left hand.
μ and ν in the right arm and hand.
ζ φ in the left leg.
η θ ϱ in the right leg and foot.

SER´PENS.

α in the heart.
β γ ϱ ι κ in the head.
δ in the first fold.
ε λ near α.
μ ν ξ ζ η.

Ophiuchus lies to the South of Hercules. These two large constellations extend from Scorpio in the South to Draco in the North. The head is known by Ras Alhague, a star of the 2nd magnitude, near the head of Hercules; and the shoulders by two pairs of stars, at equal distances from the head. The left arm is shewn by λ of the 4th magnitude, in a line with the left shoulder, and δ ε in the left hand. One foot is planted on Scorpio, between Antares and β in the head; and the right leg is marked by the bright star η of the 3rd magnitude.

The head of Serpens is to the South of Corona, its place being shewn by five stars, somewhat in the form of an hour glass.

θ in the tail is a double star, equal in size, distance 19″, a very pretty object, which may easily be divided. It is midway between the head of Taurus Poniatowski and Atair. (Vide Map 5.)

Near *b*, between Serpens and Virgo, is a fine nebula represented in plate 3, fig. 7.

MISCELLANEOUS.

n o p k in Tau′rus Poniatow′ski.

α Ve′ga *β γ δ ε ζ* in Ly′ra.

Ras′taban and Et′anin in the head of Dra′co.

Ben′etnasch *ν* and *ξ* in Ur′sa Ma′jor.

Deneb′ola.

ξ β γ π in Hy′dra.

Noc′tua.

g h i k in Centau′rus.

γ δ ε λ μ in Sagitta′rius.

Four stars in the head of Taurus Poniatowski, near the shoulder of Ophiuchus, resemble a diamond. All the stars in this constellation were formerly included in Ophiuchus; and that marked *p* in the head was numbered 70 in Ophiuchus, in Flamstead's Catalogue, and is a remarkable double star, whose period is 80 years.

QUESTIONS FOR EXAMINATION ON

MAP IV.

1. Point out Ve′ga, Ras′taban, Et′anin, Ben′etnasch, Arctu′rus, Gem′ma, Ras Al′gothi, Ras Alha′gue, Vindemia′trix, Spi′ca, Zu′ben el Chima′li, and Anta′res.

2. By what stars are the arms of Her′cules shewn?

3. What stars are immediately under Co′rona?

4. Which is the brightest star in the Northern hemisphere?

5. What is the meaning of Cor Car′oli?

6. What are the meanings of Spi′ca and Vindemia′trix?

7. On what constellation is the left foot of Ophi′uchus placed?

8. What colour is Anta′res?

9. Between what constellations is Coro′na?

10. What two bright stars are to the North of the left foot of Her′cules?

11. How is Vir′go distinguished in the heavens?

12. Point out all the principal stars in Ser'pens from the head to η in the tail.

13. Point out the nebula between ζ and η in Her'cules.

14. Between what constellations is Her'cules situated?

15. Is Spi'ca in the Northern or Southern hemisphere?

16. Point out the course of the Ecliptic.

17. When can Vir'go be seen to the greatest advantage?

18. Point out β δ π and ρ in Scor'pio.

19. In the evenings of what months may Her'cules and Ophi'uchus be seen best?

20. In what constellation were the stars in Tau'rus Poniatow'ski formerly included?

AUTUMN.

MAP V.

LY'RA.

NINE IN THE EVENING.

JANUARY, FEBRUARY, MARCH, N. W. N. and N. E.
APRIL, MAY, JUNE—N. E. and E.
JULY, AUGUST, SEPTEMBER—S. E. S. and S. W.
NEAR THE ZENITH.
OCTOBER, NOVEMBER, DECEMBER, W. and N. W.

α Ve'ga in Ly'ra β γ δ ε ζ η θ ι.

Vega, a splendid white star, of the 1st magnitude, which never sets to the British Isles, will at all times attract the eye to Lyra.

ε in Lyra, is a very curious quadruple star. At first sight it appears double, at some considerable distance; and by attending a little, we see that each of the stars is a very delicate double star; but it requires an excellent glass to separate them. (Vide plate 1.)

Exactly midway between β and γ is a very curious nebula, like a ring. (Vide plate 3, fig. 5.)

β is a variable star, declining from the 3rd to about the 4th magnitude, at irregular intervals, twice in 12 days, 19 hours.

Double stars β δ ζ η and a small star just by η.

A'QUILA, ANTIN'OUS, & DELPHI'NUS.

NINE IN THE EVENING.

JUNE, JULY—E. and S. E.
AUGUST, SEPTEMBER—S. E. S. and S. W.
OCTOBER, NOVEMBER—S. W. and W.

A'QUILA.

α A'tair.
β γ in the neck.
δ in the Southern wing.
ε ζ in the tail.
μ in the body.

ANTIN'OUS.

θ in the arm.
η in the shoulder.
ι in the side.
κ near the knee.
λ *i* in the foot.
I H G E D in the bow.

DELPHI'NUS.

α β γ δ ε.

Aquila may be easily found in the heavens by three bright stars in a right line in its neck, and ε ζ in the tail.

Antinous is directly South of Aquila, and his left foot in the Milky Way, near Scutum Sobieski.

η varies from the 3rd to the 4th magnitude.

Delphinus is known by four stars in its head, forming a rhomboid.

Double stars, γ and a star to the west of ε.

SAGITTA'RIUS·

NINE IN THE EVENING.

JULY, AUGUST—S. E. and S.
SEPTEMBER, OCTOBER—S. and S. W.

σ Φ in the arm.
τ ζ in the side.
θ γ near the hand which holds the bow.
μ in the bow.
λ ε near the bow.
ο π in the head.
d ϱ in the robe.

Sagittarius, like Scorpio, is so far to the South, that only the Northern part rises to the British Isles. This constellation may be seen in the evenings of August; and distinguished by an irregular quadrilateral, formed by σ and φ in the shoulder and arm, with τ and ζ in the breast. Over this part of the figure is a line formed of stars in the face and head, slightly curving upwards.

CYG'NUS, VULPEC'ULA, AN'SER, ET SAGIT'TA.

NINE IN THE EVENING.

May, June, July—N. E. and E.
August, September, October—E. S. and W.
NEAR THE ZENITH.
November, December, January—W. and N. W.

α De'neb or Ari'ded in the tail of Cyg'nus.
β Albi'reo in the beak.
γ in the breast.
δ ε in the pinions.
θ ι κ in the North wing.
σ υ ζ μ in the South wing.
ω ο in the North foot.
ν ξ in the South foot.
η χ Φ in the neck.
a b c i in Vulpec'ula et An'ser.
α β γ δ in Sagit'ta.

Cygnus is easily recognized by a great cross in the Milky Way, formed by five of its principal stars, which are situated obliquely, N. E. and S. W. Deneb marks the upper part of the cross, and Albireo its opposite extremity; the arms are formed by δ in the N. W. and ε on the S. E.; and nearly in the centre we find γ, at an equal distance from the two last mentioned stars, and almost in a line with Deneb and Albireo. This large cross rises horizontally in the N. E. and sets perpendicularly in the N. W.

The upper foot of Cygnus is distinguished by two clusters of stars, marked ω and o, to the N. W. of Deneb; and the other foot by ν and ζ at about the same distance from Deneb on the opposite side.

The extremity of the lower wing is shewn by μ, which, with ι and κ in Pegasus, forms a right angled triangle.

Deneb is an Arabic word for the tail; thus we have Deneb Algedi in the tail of Capricornus, Deneb Kaitos, in the tail of Cetus, &c. Deneb never sets to Great Britain.

Albireo is a beautiful double star, considerably unequal in size; large star, pale red; small one, a beautiful blue, distance 40″. (Vide plate 1.)

61 Cygnus is double; nearly equal in apparent size; distance 15″. This star has the greatest proper motion of any yet observed; amounting, according to Bessel, annually to more than 5″, or 1 degree in 700 years. This induced him to select it for the purpose of ascertaining the parallax of the fixed stars, and from a very great number of observations he states its annual parallax to be only about one third of the second of a degree. According to these observations, and the calculations founded

on them, the distance of 61 Cygnus from us is 62,481,500,000,000 miles. This remarkable star may be found in the heavens by remembering that it is in a line with Deneb and ν in the foot of Cygnus, and about half the distance from the latter which that star is from Deneb. It likewise forms a right angled triangle with σ and τ.

Double stars, 2nd and 3rd ω, μ, and one to the east of θ.

Atair, Sagitta, and Albireo, are at equal distances and in a right line.

Vulpecula et Anser consist of a confused cluster of stars, of the 4th and 5th magnitudes, between Sagitta and Cygnus.

In the shoulder of the Fox is a very curious nebula, resembling a dumb-bell. (Vide plate 3, fig. 4.)

CAPRICOR'NUS ET AQUA'RIUS.

NINE IN THE EVENING.

AUGUST, SEPTEMBER—S. E. and S.
OCTOBER, NOVEMBER—S. and S. W.

α β in the horn.

γ called De'neb Alge'di, and δ in the tail.

AQUA'RIUS.

α β in the shoulders.

ϵ μ in the hand.

δ She'at in the leg.
θ ι in the robe.
γ ζ η in the urn.
κ λ φ in Flu'vius Aqua'rii.

The best rule for finding Aquarius is, that the three stars, γ ζ and η in the urn, are below the mane of Pegasus, and equally distant from Markab and Enif. α is a little to the right of the urn; and α β in the shoulders, the two stars μ and ε in the hand, and α in the horn of Capricornus, are nearly in a right line, and equally distant from each other.

Markab, Sheat in Aquarius, and Fomalhaut are in a line, directly North and South; and consequently come to the meridian together.

PIS'CIS AUSTRA'LIS

α Fo'malhaut.
β μ λ ε.

Fomalhaut in Arabic means fish's mouth.

As Fomalhaut is only about 4 hours above our horizon, and has then very little elevation, it cannot often be seen. The best season to observe it, is, in the evenings late in the Autumn, when Pegasus is on the meridian.

PEG'ASUS ET EQUU'LEUS.

NINE IN THE EVENING.

August, September—E. and S. E.
October, November—S.
December, January—S. W. and W.

α Mar'kab, γ Al'genib in the wing.
β Sche'at in the leg.
ε E'nif in the nostril.
ζ θ in the mane.
η ι κ in the legs.
λ μ in the chest.
ν τ in the side.
α β γ δ in Equu'leus.

Pegasus and Ursa Major are excellent constellations to start from, when surveying the heavens on a clear evening.

Pegasus may be recognized by a large square, formed with its three principal stars, Algenib, Markab, Scheat; and Alpheratz in the head of Andromeda. This square is of great use in finding the neighbouring constellations; it is connected by one of its stars with Andromeda; under its centre is the Southern Zodiacal Fish; above it is Gloria Frederici; and Enif is nearly midway between Markab and that interesting little asterism, Delphinus.

MISCELLANEOUS.

c g d e b in Lacer′ta.

ι κ λ ο in Glo′ria Frederi′ci.

Al′pheratz, Mi′rach, δ ε ϖ in Androm′eda.

β γ κ λ *m* ι θ *b* in the Southern Zodi′acal Fish.

ι in Ce′tus.

n o p k in Tau′rus Poniatow′ski.

ζ η θ in Ser′pens.

λ μ ξ ο in the arm of Her′cules.

τ ρ θ ι in the leg.

Ras′taban and Et′anin in the head of Dra′co.

m n o in Scu′tum Sobies′ki.

QUESTIONS FOR EXAMINATION ON

MAP V.

1. Point out Mar'kab, Al'genib, Sche'at, Al'pheratz, De'neb, Ve'ga, A'tair, Mi'rach, and Fo'malhaut.

2. What small constellation is between Albi'reo and A'tair?

3. What small constellation is to the North of the large square in Peg'asus?

4. What constellation is to the South of it?

5. Repeat the rule for finding E'nif.

6. How is Cyg'nus found?

7. What constellation is between the head of Peg'asus and Delphi'nus?

8. What small constellation is in the Milky Way, near the foot of Antin'ous?

9. At what season can Peg'asus be seen best?

10. What two stars are in a line between the shoulders of Aqua'rius and the horns of Capricor'nus?

11. Point out Albi'reo, and De'neb Alge'di.

12. What is the course of the Ecliptic?

13. What kind of star is Ve'ga?

14. Describe ϵ in Ly'ra.

15. What is the position of the large cross in Cyg'nus at the time of its rising, and what at the time of its setting?

16. How is the urn of Aqua'rius situated?

17. Describe Albi'reo.

18. Why did Professor Bessel select 61 in Cyg'nus, for the purpose of determining its parallax?

19. What does he calculate is the distance of this star from the earth?

20. What is the meaning of Fo'malhaut?

21. When we survey the heavens, what are the best constellations to begin with?

22. Does Ve'ga ever descend below the horizon in England?

23. Point out the place of the nebula in the shoulder of Vulpec'ula.

24. What two proper names has α in Cyg'nus?

25. What stars come to the meridian with Fo'malhaut?

26. Is the whole of Sagitta'rius visible in England?

27. What is the best month for seeing this constellation, and how is it distinguished?

ON THE FIXED STARS.

CHAPTER I.

THE NATURE AND NUMBER OF THE STARS.

Of all the natural objects by which we are surrounded, few have excited more attention, or been the subjects of greater admiration, than the fixed stars. But though mankind have in all ages been captivated by their brilliancy, and used every effort to discover their nature and design; yet before the invention of the telescope, little of them was known even by the learned. And since the eye of science has been assisted by this wonderful instrument, though our knowledge of sidereal astronomy has greatly increased, there are yet many particulars relating to them, on which our information is comparatively limited and imperfect.

They evidently are self-luminous, not shining by reflected light, but by their own innate brightness. For though their precise distance is not yet perfectly ascertained, we know it is so great as to render it impossible they should shine by light derived from our sun. Each has therefore been considered as a sun, dispensing light and heat, with all their accompanying influences to a number of planets circling round it.

When directing our attention to them, on a bright evening, we are usually struck with their apparently infinite number; notwithstanding which, it is clearly ascertained, that the number of stars visible at one time does not exceed a thousand, unless we take into the account those that can be perceived by telescopes, when they indeed appear to be innumerable.

The first astronomer, so far as we know, who attempted to make a catalogue of them, was Hipparchus of Rhodes, who flourished about 120 years before Christ. This catalogue contained about 1026 stars, but others have been formed in modern times, which comprise from fifty to a hundred thousand. Immense as this number is, it includes but a very small proportion of the whole. The larger and better the glasses, the more may be discovered; but even with the best, there are myriads only just discernible.

They are by no means equally distributed in the sky. In some parts not more than two or three can be seen through a large glass at one time; while in the most crowded parts of the Milky Way, Dr. Herschel says he has had fields of view that contained no fewer than 588 stars in each; and these were continued for many minutes, so that in one quarter of an hour's time, there passed no less than 116,000 stars, through the field of view of his telescope. In the space occupied by the neck of the Swan, between β and γ of that constellation, the stars are found clustering with a kind of division between; so that they may be considered as accumulating towards two different regions. In this space, taking an average breadth of about five degrees of it, he found from observation, that it contained more than 331,000 stars. "In short," to use the words of Sir John Herschel, "the Milky Way, when examined through powerful glasses, is found, (wonderful to relate,) to consist entirely of stars, scattered by millions, like glittering dust upon the black ground of the general heavens," and the glowing appearance of this belt, is entirely owing to the combined lustre of this host of stars.

QUESTIONS FOR EXAMINATION.

1. Do the stars shine by their own or reflected light?

2. Why is it thought they do not shine by the reflected light of the sun?

3. What has each star been considered?

4. By what is each supposed to be surrounded?

5. What number of stars can be seen at one time, without a telescope?

6. Who first made a catalogue of the stars, and when?

7. How many are inserted in modern catalogues?

8. Do these include the whole that can be seen?

9. How are the stars distributed in the sky?

10. How many has Dr. Herschel seen at once through his telescope?

11. How many in a quarter of an hour?

12. How does the Milky Way appear when viewed through a telescope?

13. What is the glowing appearance of this belt owing to?

CHAPTER II.

THE MAGNITUDE OF THE STARS.

It is generally considered, that stars of the second magnitude are twice as far removed from us as those of the first—the third, three times—the fourth, four times, &c.; the difference in their apparent size resulting from the different distances at which they are placed. Although this may be assumed as true in general, yet we cannot but imagine, there is the same difference in the dimensions, motions, and even physical construction of these bright orbs as in the other works of creation.

If we suppose for a moment that they are all nearly of one size, and at about the same distance from each other as from us; their various magnitudes arising only from the different distances at which they are placed; and likewise imagine them to be scattered throughout the universe, something like the dots in fig. 1, plate 5 : then drawing several concentric circles round the earth E as a centre, all the dots enclosed in the first circle will represent the stars of the first magnitude—those between the first and second, the stars of the second magnitude, &c. The result of this supposition accords with observation; since there are not more than about twenty stars of the first magnitude; nearly four times as many of the second, upwards of ten times as many of the third, &c. the numbers increasing as the stars diminish in apparent size, till we sometimes meet with several hundreds of the more minute, in a single field of view of our telescopes. Considered in this way, we are quite justified in concluding, that these bodies are not all at the same distance from us, nor does the difference in their apparent size result, principally, from a real difference in their magnitudes. There is, notwithstanding, one circumstance which seems to indicate a considerable diversity in their bulk; viz. that some of the smaller stars are observed to have a greater proper motion than the larger ones. Now as a vast number are observed to have a constant, though extremely slow motion, it appears highly probable, that none are absolutely at rest. We should therefore expect that the change of place in those, nearest to us, would be the most perceptible, and consequently the greatest in stars of the 1st or 2nd magnitudes. We have, however, a remarkable instance to the contrary in 61 in Cygnus, which, though only of the 5th magnitude, is subject to a greater proper motion than has been observed in any other. If, therefore, we conclude, that this star is nearer to us than Sirius, Arcturus, and others of that class, it must intrinsically be much smaller, and thus prove, that there is a great difference in their real dimensions. But till the distance of the fixed stars is ascertained, we have no data from which to estimate their admeasurement. We are perfectly certain, as the distance must be very great, they are bodies of immense size; otherwise, they would be altogether invisible from our terrestrial sphere, or from any part of the solar system; and from all the observations and reasonings which have been entered into on this subject; we have no proof that any of the stars are less than the sun, but it is more probable that many of them equal, and even far surpass that luminary in their dimensions and splendour.

QUESTIONS FOR EXAMINATION.

1. How much further from us than stars of the 1st magnitude are those of the 2nd, 3rd, and 4th generally considered to be?

2. To what is the difference in their apparent sizes supposed to be owing?

3. What are we quite justified in concluding from there being so many more small than large stars?

4. What are a number of the stars found to have?

5. Is it probable any of the fixed stars are absolutely at rest?

6. The motion of which stars is likely to be the most perceptible?

7. Which star has the greatest proper motion of any that have been observed?

8. If we conclude that 61 in Cygnus is nearer to the earth than Arcturus and Sirius, what does this prove in respect to its size, and to the stars in general being of one dimension?

9. Why cannot we estimate the real size of the stars?

10. Why are we certain the stars are bodies of immense size?

11. What have we no proof of?

12. What is most probable in reference to their size?

CHAPTER III.

THE DISTANCE OF THE STARS.

To find the distance of the fixed stars has been a problem which many eminent astronomers have attempted to solve; but about which, after all, we remain in some measure still in the dark. For the purpose of furnishing astronomers with the proper means of determining this difficult question, Dr. Herschel published his valuable catalogues of double stars, which have led to such important discoveries in another branch of this interesting science, and which will be noticed in their proper place.

The method of ascertaining the distance of these bodies from us, is to select two or more stars very close to each other, and of different magnitudes; the first circumstance is important, that the space may be measured with the greater nicety, and the latter, because it is generally considered, where two stars do not form a binary system or double star, that the smaller is more distant than the larger: they are then viewed in opposite seasons from opposite parts of the earth's orbit. Thus (plate 5, fig. 2,) let S represent the sun, A B C D the earth's orbit, E and F two stars selected for this purpose. When viewed from C, the star E would be seen in the line C E, and the star F in the line C F, but when observed from A, the opposite point of the earth's orbit, 190 millions of miles from C, they would respectively be seen in the lines A E, and A F, evidently appearing much further apart in the latter case than in the former. This would happen, if the diameter of the earth's orbit bore any sensible proportion to the distance of the fixed stars, in which case the alteration in their distance would be perceptible, and from thence astronomers would, without difficulty, be able to determine their distance from us.

Dr. Bradley and other eminent astronomers assert, that had this difference, called

Pl. 5

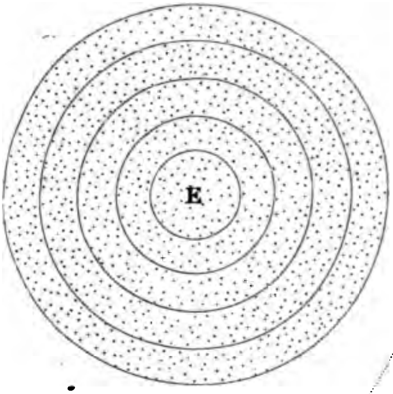


Fig. 1.

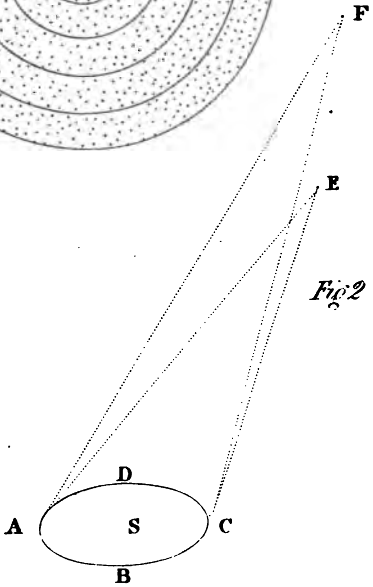


Fig. 2

e parallax of these bodies, been only a ngle second of a degree, or a space equal the two thousandth part of the apparent ameter of the sun or moon, such are the mber and accuracy of their observations, at they must have detected it; but even is minute difference they were never able discover. Supposing it however to be a ngle second, even in that case, the distance f the nearest fixed star almost exceeds elief, being no less than 20,140,000,000,000 r more than twenty billions of miles.

But within the last few years, Professor Bessel, of Berlin, from a great number of bservations, with a telescope of very large dimensions, states that he has ascertained the parallax of 61 in Cygnus to be only one third of a second of a degree, or the six thousandth part of the diameter of the moon. This difference is so minute, that it requires to be verified by other observations; and as instruments are improved, there is little doubt that the difficulties will yield to the industry and perseverance which are employed in this department of science.

But if Professor Bessel's observations can be depended on, then will the space that intervenes be three times as far as above stated, viz. 62,481,500,000,000, or sixty-two billions, four hundred and eighty-one thousand, five hundred millions of miles. There is no difficulty in expressing this number in figures, though the mind is utterly incapable of forming any conception of its extent; and when we calculate the time it would occupy for those bodies, whose motion is the most rapid we are acquainted with, to pass over this space, the result is almost incredible. Supposing a carriage on a railroad to travel 60 miles per hour, day and night, it would be 118,756,659 years in moving this distance; which is about 20,000 times the number of years that have elapsed since the creation.

But the swiftest motion we are acquainted with is that of light, which moves at the rate of twelve millions of miles in a minute. The circumference of our globe is twenty-five thousand miles; yet would this subtle agent move through eight times that distance in a single second of time, or round our earth in the eighth part of a second; it requires only a second and a quarter in passing from the moon to the earth, and eight minutes to travel ninety-five millions of miles, the distance of the sun from the earth; yet, although flying with this inconceivable velocity, does it require 10 years and 114 days to dart across the mighty interval, which separates us from the nearest fixed star.

As, therefore, we behold bodies that are self-luminous only by the light that emanates from them, it follows that when we are looking at the fixed stars, we do not behold them as they exist at the time of observation, but as they were ten years before; thus, when I view a star in 1842, I behold it really as it existed in 1832, the rays of light entering my eye having been the intermediate ten years on their journey; and should a new star be created we must be ignorant of its existence for ten years, as the first ray which it emitted would require that time to reach our earth; and should one of the stars become extinct, the light which last left it would be ten years before it arrived at our world, and it would thus appear to be visible ten years after it really was extinguished.

Of course these calculations apply only to those stars whose distance is the least, but if we imagine with Sir W. Herschel, that a star of the 2nd magnitude is at twice the distance of one of the 1st, the 3rd at twice the distance of the 2nd, &c. at what an immense distance must those minute points be which are just perceptible through the most powerful glasses! The almost infinite space which intervenes between us and them seems to justify the surmise of Huygens, that it is not improbable there are stars so distant that although their light has been travelling ever since the creation, it has not yet reached the earth.

QUESTIONS FOR EXAMINATION.

1. Has the precise distance of the fixed stars been ascertained?

2. Who published a catalogue of double stars, and for what purpose?

3. What are selected for the purpose of ascertaining their distance?

4. What two circumstances are required, and why?

5. Describe from plate 5, fig. 2, the method of finding the distance of the fixed stars?

6. What part of the diameter of the sun or moon is a second of a degree equal to?

7. Supposing the parallax of a star to be a second of a degree, what would be its distance?

8. Upon what star did Professor Bessel make a great number of observations?

9. What does he state the parallax and distance of 61 in Cygnus to be?

10. In what time would a carriage on a railroad travelling 60 miles per hour, pass over this distance?

10. How far does light travel in a second?

11. How long is it in passing from the moon, the sun, and the fixed stars?

12. Mention some circumstances illustrative of the immense distance of these bodies?

CHAPTER IV.

NEW STARS.

THERE are many indications, that extensive changes are frequently taking place in the vast regions by which we are surrounded. Among the celestial phenomena that have excited the attention of astronomers, may be reckoned the appearance, in different ages, of new stars.

The first of these visitants was observed by Hipparchus of Rhodes, about 120 years before the Christian æra, which induced him to make a catalogue of the stars, and between this time and the year 1572, three or four others were seen; but in the latter year, a new star was observed in Cassiopeia, forming nearly a rhombus with the three largest stars, α β and γ in that constellation. Its appearance was sudden, and so brilliant as to surpass Lyra and Sirius. It shone with its greatest splendour for about three weeks, and after that, gradually diminished in size for about fifteen months, and then became invisible. In 1604, another was seen, near the heel of the right foot of Serpentarius.

All the new stars on record seem, like the above, to have burst forth at once with great brilliancy, and afterwards gradually to have become fainter, till they could no longer be seen, and have never re-appeared.

As no records are preserved of more than five or six of these new stars, and those having been observed at long intervals, and before the invention of telescopes, astronomers are very much in the dark, as to their nature, and the cause of their sudden appearance and departure.

QUESTIONS FOR EXAMINATION.

1. What remarkable appearances in the sky have been seen in different ages?
2. Who observed a new star before the Christian æra, and what did it induce him to do?

3. Describe the place and the appearance of the new star in Cassiopeia?

4. In what way do these stars usually first appear, and how do they disappear?

5. How many of these stars are recorded to have been observed?

CHAPTER V.

VARIABLE STARS.

Among other remarkable phenomena of the heavens, may be reckoned the variable or periodical stars. These are found to change from a greater to a less degree of brilliancy, and back again in certain periods.

The following are among the most noted of this class; Mira, or the wonderful star, in the neck of Cetus. It remains in its greatest brightness about a fortnight, being then nearly equal to a star of the second magnitude; it decreases during three months, till it becomes completely invisible; in which state it remains about five months, when it again becomes visible, and continues increasing during the remaining three months of its period, but it does not always return to the same degree of brightness, nor increase and diminish by the same gradations. But after it has disappeared to the naked eye, it may be traced to its lowest magnitude with a telescope of moderate powers. (Vide map 2.)

Another of these variable stars is Algol, in Caput Medusæ. It usually appears of the second magnitude, and such it continues for the space of 2 days, 14 hours, when it suddenly begins to diminish in splendour, and in about 3½ hours is reduced to the 4th magnitude. It then begins to increase; and in 3½ hours more, is restored to its usual brightness; going through all its changes in 2 days, 20 hours, 48 minutes, or thereabouts. (Vide maps 1 and 2.)

A few other stars, smaller than these, have been observed to vary about one magnitude, but the above-mentioned are the most remarkable. Several conjectures have been formed to account for this periodical variation. Sir W. Herschel says, dark spots on large portions of the surface, less luminous than the rest, turned alternately in certain directions, either towards or from us, will account for all the phenomena of periodical changes in the lustre of the stars so satisfactorily, that we certainly need not look for any other cause. Other astronomers, however, have imagined that the occultation is occasioned by the interposition of opaque planetary bodies, revolving round these luminous bodies, as our earth does round the sun. Whichever of the above solutions we adopt, these appearances render it highly probable, not only that the stars, in common with our sun, and all the planetary bodies, within our observation, revolve on their axes, but that they are accompanied by numerous worlds, to which, they are constantly dispensing light and heat, with all their attendant blessings.

QUESTIONS FOR EXAMINATION.

1. What are variable stars?
2. Relate the changes to which Mira is subject.
3. Do the same with those of Algol.

4. How does Sir W. Herschel account for these appearances?

5. What have other astronomers imagined?

6. What two circumstances does the variation in the stars render highly probable?

CHAPTER VI.

DOUBLE, TREBLE, AND QUADRUPLE STARS.

AMONG all the discoveries of that celebrated astronomer, Sir W. Herschel, none have been so wonderful and important as that of double, treble, and quadruple stars. Previous to about 1776, when, furnished with his excellent and powerful instruments, he undertook a survey of the heavens, a few of these bodies were known to be double; but in the Philosophical Transactions for 1782 and 1785, he has presented us with lists of a thousand of these very curious objects.

To the naked eye, a double or treble star exhibits no appearance, that would lead us to imagine it differed from the surrounding ones. Without the aid of telescopes, and frequently very powerful ones, they cannot be seen double; if they are so far apart as to be distinguished separately without a glass, they are not classed with the double stars, but are properly two distinct ones. The component parts of these very curious objects are sometimes equal or very nearly so; the combination is often a larger accompanied by a smaller, like a planet and its satellite; the latter sometimes so minute as to require telescopes of the most exquisite workmanship to render it visible. This great excellence in the instruments is frequently requisite to separate them; for many are so close, as when magnified even 200 times, to appear only like a single star; but with a power of 400 or 500, they have been clearly divided. The following extracts from Dr. Herschel's first catalogue of double stars, will convey some idea of their minuteness; as well as the indefatigable zeal and perseverance of this excellent observer.

"η in Corona Borealis, double, a little unequal, they are whitish stars, they seem in contact with 227, and though I can see them with this power, I should certainly not have discovered them with it. With 460, less than a quarter diameter apart. With 932, fairly separated, and the interval a little larger than with 460. With 460 they are as fine a miniature of ι in Bootes, as that is of α in Gemini. (Vide plate 1.)

"One of the most minute of all the double stars I have yet found, is the small telescopic star near the preceding *h* in Draco, considerably unequal, both dusky white, inclining to red. With 460, they seem in contact; I have however had a very good view of a small dark division between them; they are too minute for any micrometer I have. It is in vain to look for them, if every circumstance is not favourable. The observer, as well as the instrument, must have been long enough in the open air, to acquire the same temperature. In very cold weather, an hour at least will be required; but in moderate temperature, half an hour will be sufficient.

Another circumstance which adds greatly to the interest of these telescopic objects, is the beautiful colours they exhibit; as the following extracts from the above-mentioned catalogue will shew.

"η in Cassiopeia, double, very unequal; larger, fine white; smaller, fine garnet; both beautiful colours.

"γ in Andromeda, Almaach, double, very unequal; larger, reddish white; smaller. fine light sky blue, inclining to green; a most beautiful object.

"Albireo, β in Cygnus, double, considerably unequal; larger, pale red; smaller, a beautiful blue." (Vide plate 1.)

It is perhaps necessary to remark, that the observations on these stars were made with telescopes 10 or 20 feet long. While therefore, it would be in vain to look for the more remote objects of this class with ordinary glasses, neither must we expect to see the colours with the brilliancy and beauty they are described above. Many of the double stars are, notwithstanding, easily separated with common glasses, of moderate power. I would recommend those, who wish to examine these curious objects, and try the power of their glasses; first to be quite sure they know the stars they intend to inspect, and then to begin with those which are the widest, and most nearly equal in size; and afterwards to proceed to the closer and more unequal.

For the use of persons having telescopes, but who have not access to the several catalogues of double stars, nebulæ, &c. contained in the Philosophical Transactions, I have subjoined a number of them, selected from that storehouse of astronomical knowledge; these are arranged under each constellation, and will be found among the notes to the lessons in the early part of this volume. Those most easily seen are usually placed first, it will therefore be desirable to begin with them, and proceed in something like the order in which they are placed in each constellation, and young astronomers must not be discouraged, nor condemn their glasses, if they cannot separate the more minute.

Whether the coloured appearance of these distant bodies, be inherent, or arises from their position in respect to each other, is a question on which philosophers are not agreed. Sir J. Herschel says, "insulated stars of a red colour, almost as deep as that of blood, occur in many parts of the heavens, but no green or blue star, of any decided hue, has, we believe, ever been noticed, unassociated with a companion brighter than itself."

QUESTIONS FOR EXAMINATION.

1. What is meant by a double star?
2. Who discovered a great number of these curious objects?
3. Are all the double stars at the same distance from each other?
4. Describe the different kinds of double stars?
5. What circumstance often renders the combination of these stars very beautiful?
6. On what question, in relation to these bodies, are philosophers not agreed?
7. What does Sir J. Herschel say occurs in many parts of the heavens?

CHAPTER VII.

BINARY SYSTEMS.

SIR W. Herschel's object, in making his lists of double stars, was principally with a view to determine their annual parallax; but they led to important results of another kind, which he did not at that time anticipate. In these catalogues, he not only recorded the comparative sizes, and different colours of these interesting objects; but the distance and relative situation of their component parts. On examining them for about twenty years, he was much surprised to find a considerable change take place in the relative position of several, so that a line joining the two, altered its direction; in fact, that the two bodies composing a binary star, mutually circling round each other, or rather round the centre of gravity between them. This discovery was announced by Sir. W. Herschel in 1803, and as great attention was immediately directed to them, the periods in which the revolutions of several are performed, have been ascertained. Some of these are of great length; while others have made more than one revolution since they were first observed.

Upwards of sixty instances of decided change in the position of the two parts of different binary stars have been observed. Among the most conspicuous of those, whose respective periods of revolution have been determined, are the following:

γ	in Leo	1200 years.
γ	Virgo	628 years.
61	Cygnus	452 years.
σ	Corona	286 years.
	Castor	252 years.
70	Ophiuchus, or *p* in Taurus Poniatowski	80 years.
ξ	Ursa Major	58 years.
ζ	Cancer	55 years.
η	Corona	43 years.

Here then, instead of one sun, surrounded with a number of planets, we discover two, mutually attracting each other, and circling round their common centre of gravity; each, most likely, the centre of a system, and the source of light and heat to surrounding worlds. When the orbits of these binary systems are perpendicular to the line in which we behold them, they appear to us to remain nearly at the same distance from each other, during the whole revolution; as in the case of Castor and some others, only altering their relative position: thus—Let A and B, fig. 1, plate 6, be the two stars, equal in size, moving in the same orbit, round the common centre of gravity C. While one moves from A to E; the other will pass from B to D; and when they shall have performed one quarter of a revolution, that which commenced at A, will be found at G, and the other at F, evidently continuing at the same distance, while a line connecting the two, would constantly alter its direction. When the orbits of these bodies lie obliquely to our view, their apparent motion and distance apart, are subject to great variation; thus, when one is at A, (fig. 2,) and the other at B, they would appear the farthest asunder; but when each has moved through a quarter of its orbit, and they are respectively at F and G, travelling in opposite directions, one to the right, and the other to the left, the change in their apparent distance and position will be comparatively rapid; but while passing round those parts of their path about A and B, the one advancing towards, and the other receding from us; the variation in their distance and position would, for a considerable time, be scarcely perceptible. Sometimes the plane of their orbits is in the same direction as our line of vision. In this case, they appear farthest apart at A and B, (fig. 3,) when their apparent motion, as in the last case, is very slow; their rate of travelling, however, is gradually increased as they mutually approach the centre C, where it is most rapid, on reaching which, they no longer exhibit the appearance of two bodies, but one; the nearest passing in front of the other. When in this position, they cannot, even with the most powerful glasses, be distinguished from a single star. Here then we have a phenomenon quite new in astronomy; viz. the occultation of one star by another, this is very nearly the case with the star ζ in Hercules. With a power of 460, in July, 1782, the two stars were half the diameter of the smaller one asunder. In 1795, Dr. Herschel found it difficult to perceive the small one with the same power. In 1802, it could no longer be seen at all, but the apparent disc of the larger seemed to be a little lengthened one way. With his 10 feet telescope, and a power of 600, he found it to have the appearance of a star in the form of a wedge. On the 11th of April, 1803, he examined it again with a power of 2140, and found it, as before, a little distorted, but there could not be more than about three-fourths of the apparent diameter of the small star wanting, to render it a complete occultation.

Pl. 6

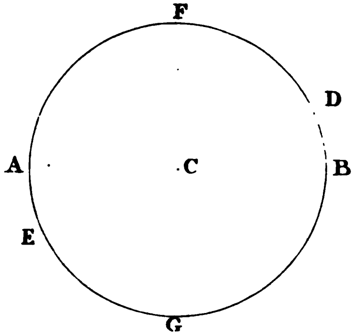


Fig. 1.

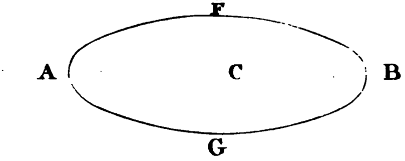


Fig. 2.

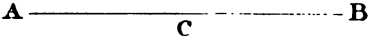


Fig. 3.

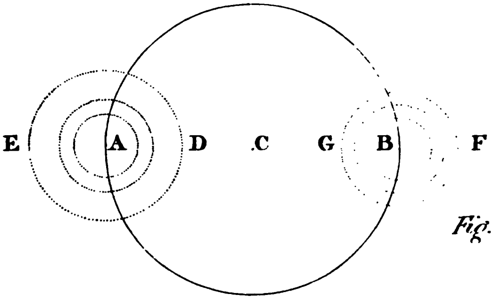


Fig. 4.

“ Most probably” he observes, “ the ath of the motion is not quite central; if , the disc will remain a little distorted uring the whole time of the conjunction. he star γ in Virgo, has presented henomena nearly similar to those of ζ n Hercules.

The discovery of these binary systems of tars, in which two suns appear mutually evolving round each other, has afforded ample scope for the imagination to expatiate in. We cannot forbear sometimes imagining, what are the circumstances of the beings by whom the planets are inhabited, which, in all probability, circle round the adjacent luminaries.

Supposing A and B, fig. 4, to be the bodies we behold, as the component parts of a double star; and each to be surrounded by planets, moving in orbits represented by the dotted circles. When these surrounding A, arrive at D, or any of the other set at G, they would be placed between two suns, a nearer and more distant one; and, if they revolved on their axes, would experience the extraordinary phenomenon of having one of those luminaries rise when the other sets; and when either was in the opposite point of its orbit; as, at E, or F; both suns would appear in the same part of their firmament, rising and setting together.

QUESTIONS FOR EXAMINATION.

1. What was Dr. Herschel's principal object in making his list of double stars?
2. What remarkable change did he discover in these bodies?
3. What kind of motion in them did he discover?
4. What has been ascertained relative to the double stars?
5. Is the time of revolution alike in all these bodies?
6. In how many double stars have decided changes been observed to take place?
7. Mention the most remarkable of them, and the periods in which they revolve.

8. What is it probable each part of a double star is?

9. How do they appear when their orbits are perpendicular to the line in which we observe them?

10. Explain by fig. 1, plate 6, the changes to which these stars, when in this position, are subject.

11. Explain by fig. 2, the changes when their orbits are oblique to our line of vision.

12. Describe by fig. 3, their appearance when their orbits are in the same direction as our line of vision.

13. Describe by fig. 4, the circumstances in which we may imagine the beings are placed, who inhabit the planets by which these double stars are surrounded.

CHAPTER VIII.

NEBULÆ.

In many parts of the heavens, we may observe with the unassisted eye, groups or clusters of stars. In these rich spots, a number of stars of different magnitudes, are congregated together. Of this kind are the Hyades, the Pleiades, and Coma Berenices. When such associations are examined with powerful instruments, a vast number of stars of different magnitudes become visible, which were entirely unseen without their assistance. (Vide plate 4.) When these clusters are so distant, that none of the individuals of which they are composed can be discerned without the aid of glasses; they are called, from their cloudy appearance, nebulæ, a latin word, signifying clouds or mists. A few of the larger nebulæ, as that near γ in Andromeda, and Prœsepe in Cancer, are visible to the naked eye; but they are, for the most part, telescopic, and beyond the reach of any, but the most powerful instruments.

There are various forms and kinds of nebulæ, but they may all be reduced to two great classes; the resolvable, and the irresolvable; that is, those which may be resolved into clusters of stars by powerful telescopes, of which kind Prœsepe in Cancer is an example, (vide plate 4,) and those which no telescope hitherto constructed, has yet been able to resolve into starry groups; of which latter kind the above-mentioned nebula in Andromeda, (vide plate 3, fig. 2) and the remarkable one in the sword of Orion are instances.

These mysterious objects exhibit a great variety of forms. Resolvable nebulæ are almost universally round or oval. Irresolvable are sometimes spindle-shaped, in other cases, but more rarely, their form is that of a broad ring. Sometimes the nebulosity is spread over large spaces in the heavens, but so faintly as to be visible only through powerful glasses. Vast multitudes are so faint as to be with difficulty discerned at all, till they have been some time in the field of the telescope. The nature of these dim objects, which seem to be even further removed from us than the fixed stars, has been the subject of much speculation. That by far the greater number of them consist of stars, there can be little doubt, but sometimes the nebulous matter, exhibiting a self-luminous or phosphorescent appearance, seems to be disseminated through extensive regions of space, in the manner of a cloud or fog; while in other cases, it is so much concentrated, that it looks like a star with a burr round it. The only point of resemblance which obtains in all nebulæ, is that they are self-luminous, by which they are rendered visible, notwithstanding the immeasurable distance that intervenes between them and us. But though the nature of these obscure objects is involved in much mystery, we may reasonably hope, that as instruments are improved, they will yield to the skill and perseverance employed in this department of science; and that many particulars, relative to their mode of existence, will be discovered.*

In plate 3, will be found a representation of some of the more curious objects of this class, which are described in the lessons in the early part of this volume. They are in the following constellations.

No. 1. Hercules.
2. Andromeda.
3. Canes Venatici.
4. Vulpecula.
5. Lyra.
6. Between Algol and Almaach.
7. In Serpens.

QUESTIONS FOR EXAMINATION.

1. What is the difference between clusters of stars and nebulæ?

2. Are they generally visible to the naked eye?

3. How many classes are they divided into?

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* The Philosophical Transactions for 1833, contain a splendid paper by Sir J. Herschel, comprising a list of 2500 nebulæ and clusters of stars, with very beautiful drawings of the most remarkable.

4. What is meant by resolvable and irresolvable nebulæ?

5. Give an example of each.

6. What is the usual shape of resolvable nebulæ?

7. Mention the shape and general appearance of different nebulæ.

8. What is the only point of resemblance among them?

9. What is said of the nature of these objects?

CHAPTER IX.

FALLING OR SHOOTING STARS.

It is seldom we are abroad for any considerable time in a clear evening, without having our attention arrested by falling or shooting stars. Although most frequent in tropical regions; yet are they common to all parts of the earth, and perhaps, in this country, are more numerous in the autumn than in any other season. They seem to burst suddenly upon our view, and to dart, with great rapidity, across the heavens, leaving a train of light behind them till they become extinct. They have been observed to move in every direction except upwards. Their altitude must be very considerable; for Brydone informs us, he observed some of these meteors from the summit of Mount Etna, which still appeared to be as much elevated above him, as those seen from the plain; so that in all probability, they move in regions near the bounds which philosophers have assigned to our atmosphere. At different periods, these bodies have appeared in such numbers and splendour, as to have become objects, not only of the highest admiration, but of terror. This was particularly the case on the evening of the 12th, and the morning of the 13th of November, 1833, in the United States of America. The following abridged account of this phenomenon, from the New York Commercial Advertiser of Nov. 13th, 1833, is from Dr. Dick's "Sidereal Heavens," (page 320,) where may be found a further description of these extraordinary appearances.

"The sky was remarkably clear on the night of this remarkable phenomenon. Some time before twelve o'clock, the meteors so frequently seen on summer evenings, called shooting stars, were observed to fall with unusual frequency and splendour. They continued from that hour to flash athwart the skies more and more, until they were eclipsed by the glories of the rising sun this morning. From four to six, they were most numerous and refulgent. Within the scope that the eye could contain, more than twenty could be seen at a time, shooting, (save upward) in every direction. Not a cloud obscured the broad expanse; and millions of meteors sped their way across it on every point of the compass. Were it possible to enumerate them in the swiftness of their arrowy haste, we might venture to say that for the space of two hours, intervening between four and six, more than a thousand per minute might have been counted. Their coruscations were bright, gleamy, and incessant, and they fell thick as the flakes in the early snows of December. In one instance, we distinctly heard the explosion of a meteor, that shot across to the north-west, leaving a broad and luminous track; and witnessed another, which left a path of light that was clearly discernible for more than ten minutes after the ball, if such it be, had exploded. Its length was gradually shortened, widening in the centre, and apparently consisted of separate and distinct globules of light, drawing around a common centre, glimmering less and less vividly, until they finally faded in the distance. Compared with the splendour of this celestial exhibition, the most brilliant rockets and fireworks of art, bore less relation than the twinkling of the most tiny star to the broad glare of the sun. The whole heavens seemed in motion, and never before has it fallen to our lot to observe a phenomenon so magnificent and sublime."

Similar appearances, though less brilliant, were observed, both in Europe and America, on the night between the 12th and 13th of November, in the years 1834, 1835, 1836, and 1837; and although for the last few years, the accounts have not been so striking, yet the recurrence of the same phenomenon on the same night in successive years, should induce us attentively to observe the heavens at this season.

From the suddenness, with which these meteors make their appearance, their evanescent characters, and the rapidity with which they move, it is evident they are almost infinitely nearer to us than the fixed stars, and are entirely of a different nature. Many philosophers are of opinion, that they have their origin beyond the limits of our atmosphere, which they enter with amazing velocity, and being of a combustible nature, thence become ignited, and exhibit the luminous appearance we observe, till they become extinct, and the matter of which they were composed is dissipated. Many of them must be bodies of great magnitude, or they could not be visible at the distance they are from us. But of their nature and origin, as well as the purpose they are intended to answer in the economy of nature, we are almost entirely ignorant.*

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* For more extensive and minute information on the several topics introduced in this brief sketch of Sidereal Astronomy, the student is referred to the Transactions of the Philosophical and Astronomical Societies, and especially to "Dr. Dick's Sidereal Heavens;" the best book on the fixed stars ever published, being alike distinguished for the accuracy and extent of its information, as for that genuine piety which is characteristic of all the publications of its gifted author.

QUESTIONS FOR EXAMINATION.

1. Describe the general appearance of falling or shooting stars?

2. What does Brydone relate of them?

3. When have they been observed in great numbers?

4. Are they of the same nature as the fixed stars?

5. What peculiarities connected with them shew they are not?

6. Where do many philosophers imagine they have their origin?

7. When do they ignite?

8. Why must they be bodies of great size?

9. What is said of their nature and origin?

CONVERSATIONS
ON THE HEAVENS.

CONVERSATION I.

JANUARY—Ten in the Evening.
FEBRUARY—Eight.

A. A clear evening at this season of the year, certainly affords one of the most brilliant prospects in nature. The extreme transparency of the atmosphere, enables us to perceive many minute stars, even of the seventh magnitude; while those of every size, seem to vie with each other in contributing to the splendour of the firmament.

B. How many large stars are present! What is the name of this beautiful white one, nearly over our heads?

A. Capella, in the shoulder of Auriga; and observe the β in the other shoulder, a short distance to the east, and those three smaller stars, forming a triangle, near Capella; how bright they are!

B. I suppose that large star between the shoulders of Auriga and those of Orion, is β in the extremity of the Bull's northern horn, on which the foot of Auriga is placed, and the smaller star, somewhat under it, is ζ in the southern horn.

A. Just so. Now you may easily make out all the stars in Auriga, and then direct your attention to that most beautiful of all the constellations, Orion.

B. He is indeed the most beautiful! I have no difficulty in finding him. How elegantly the stars are arranged! The three in his belt, so equal both in size and distance, Betelgeuse and Rigel, on opposite sides of the belt, in one direction, and Bellatrix and ϰ in the other; and what interesting little stars are the three in his face. Surely the cluster below the belt, and near the point of the sword, must shine with unusual lustre this evening; they seem to emit more light than any others of the same magnitude.

A. This arises from their being in the large nebula, a very interesting object, which I will show you the first convenient opportunity, through a telescope, but it must be when the moon is absent.

B. How beautifully white is Rigel, and how different from the red hue of Betelgeuse.

A. True, and Sir J. Herschel has recently discovered, that the latter is subject to considerable variation in its lustre. This he ascertained by comparing it with the adjacent large stars. It may now therefore be classed among the variable stars.

B. Lepus, I see to the south of Orion. But what stars are those between Rigel and Cetus, the latter of which is setting to the south of the west.

A. They are in Fluvius Eridanus. You may perceive the γ considerably to the right of Lepus, and having the same altitude. How faint are those three stars in Sceptrum Brandenburgium, under the bend of the River!

B. Now let us look at Taurus, just past the meridian, I know him by the Pleiades and Hyades, and his red looking eye, Aldebaran. What an excellent V is formed by the principal stars in the latter cluster!

A. We shall soon lose Aries for this season. Mark the three bright stars in his horns, in mid heaven to the west. They are nearly perpendicular, the upper one being the largest, and the lower smaller than the other two; over them are Triangulum and Musca.

B. What are those three stars of the 2nd magnitude in a perpendicular straight line to the right of Aries? The middle one and Aries have the same altitude.

A. They are the principal stars in Andromeda; the μ and ν are to the right of Mirach, the centre star of the three. You may recollect I told you they rise horizontally, and set perpendicularly in England.

B. What is the reason of that?

A. Because they are placed obliquely on the meridian. You may easily prove this by elevating the north pole of the celestial globe about 52 degrees, and bringing this constellation to the eastern and western horizon, and the meridian, when you will see them in the positions I have mentioned. The three principal stars in Cygnus; Deneb, γ, and Albireo, are similarly placed, and exhibit the same appearances.

B. I suppose those stars to the west of the zenith, between Auriga and Andromeda, are in Perseus.

A. They are. You may observe his leg, north of the Pleiades; and Algol, between Algenib and Musca.

B. I can; as well as the W made by the five principal stars in Cassiopeia on his right; and Cepheus considerably lower in the same quarter. What bright star is that below his crown?

A. Deneb. The head of Cygnus and part of its neck is set. That glittering white star, to the right of Deneb, and much lower, is Vega in Lyra.

B. Now let us turn towards the east. What a splendid white star is Sirius, considerably to the left of Orion, and somewhat lower!

A. And observe the β in his foot, to the right of Sirius. Can you shew me Gemini?

B. O yes. I know them from Castor and Pollux, as well as the line of stars in their feet; besides the fore-foot of Ursa Major always points to them.

A. What is that large star, under Gemini, and nearly in a line with Sirius and Pollux?

B. I suppose it is Procyon, by the β nearly over it, and the head of Hydra, which I observe ascending on its left, in the south-east.

A. You are right. And that large space between Canis Major and Canis Minor, is occupied by the modern, and comparatively uninteresting constellation, Monoceros.

B. What a magnificent arch the Galaxy forms from south-east to north-west. What myriads of stars it must contain, to produce that brilliant glow!

A. They are doubtless the source of its light, as it is found, when examined with glasses, to be thickly studded with them, throughout, to the fifteenth or sixteenth magnitude; closer of course in some parts than in others. I believe it was between the shoulder of Orion and the feet of Gemini that Dr. Herschel saw with one of his large glasses, 116,000 in a quarter of an hour. Can you tell me through what constellations the Milky Way passes, commencing at the south-east?

B. I think I can. Sirius is just to its right; and it ascends between Canis Major and Minor, over the head of Monoceros, between the feet of Gemini and Orion, the bright stars in the extremity of the Bull's horns are on its western edge; it passes the southern part of Auriga, just reaching the triangle in the kids, surrounds nearly the whole of Perseus, part of Cassiopeia, envelopes the head of Cepheus, and is lost below the horizon in Cygnus, which is setting in the north-west.

A. Very well. Now let us turn to the north-east, where, you see, Sir Bruin is slowly ascending. It was certainly very ingenious to place three of his feet upon those three very pretty pairs of stars. Below him you may just discern Cor Caroli.

B. I can. But what is that misty looking cluster, a short distance to the right of Charles's Heart?

A. Coma Berenices; and still farther to the right, due east, Leo may be distinguished, by Regulus, and the three bright stars in his shoulder; and between Leo and Gemini to the North of Hydra's head, I can discern the cloudy Prœsepe in Cancer.

B. What a blank there is between Auriga and Ursa Minor, Ursa Major and Cassiopeia.

A. That part of the sky is occupied by Camelopard and Lynx, both uninteresting modern constellations; the latter is placed to the north of Gemini, between Auriga and Ursa Major.

B. The principal stars in Ursa Minor I see are below Alruccabah. To what constellations do those under it belong, in the northern part of the heavens?

A. To Draco. You may observe the two bright stars in his head, due north, near the horizon; the left hand one is rather the lowest; his tail is between the two Bears.

B. As the moon is both a beautiful and a useful object, and as tracing its progress in succeeding evenings is an interesting employment, will you have the goodness to give me a rule, by which I may determine its path before hand; and know where I may expect to see it at any future time?

A. Most readily. You will please to remember, that though the moon, as well as the sun and stars, rises in the east, and sets in the west, that motion is only apparent, being caused by the diurnal rotation of the earth in the opposite direction. The lunar motion is, really from west to east or from right to left, as we are situated, and she passes over about 13 degrees daily. Now as the moon's diameter is about half a degree, she will pass through a space equal to her own width in about an hour, or twenty six times her diameter daily. If therefore you observe a star about that distance to the left of the moon in the direction of her orbit, you will find her near it on the succeeding evening.

B. That, I think, I understand, but it relates only to the rate of the lunar motion. What I wish to know is, not only how fast she moves, but in what direction.

A. And that I am now going to teach you. Although the moon's orbit does not exactly coincide with the ecliptic, but is sometimes rather more than five degrees to the north, and at other times the same distance to the south of that line, we may consider she moves upon it, which will enable us to determine her path, with sufficient precision for our purpose. You have therefore only to learn the direction of the ecliptic, which is by no means difficult, especially as you may remember it passes through the signs of the zodiac.

B. That makes it very easy. Then looking at the heavens, as they are now before us, I suppose she would pass from Aries, yonder in the west, to Taurus, and then through Gemini, Cancer, and Leo.

A. Just so. Only it will be desirable you should recollect through what part of each sign the ecliptic passes; which I would recommend you to learn from the maps. In this part of the heavens, it proceeds considerably to the south of the Ram's Horns, between the Pleiades and Hyades, over the foot of Castor, which is its most northern point, and the sun's place on the longest day; then between the two stars in the knees of Castor, to the south of Prœsepe in Cancer, and very near Regulus, now rising in the east.

B. I thank you; and hope with a little practice to become expert in determining the lunar path in the heavens.

CONVERSATION II.

MARCH—Ten in the Evening.

APRIL—Eight.

B. We have now to regret the departure of that brilliant assemblage of splendid constellations, which adorned our winter skies. Orion, Taurus, and Canis Major are quickly descending in the west and south-west; their bright associates, Gemini and Canis Minor, are past the meridian; after a few short weeks, they likewise will be lost in the solar beams, and become invisible.

A. Still, I think, we are amply compensated by the varied beauties of their successors. Observe that fine constellation Leo, full south, and Virgo, just risen in the south-east. These, although less striking than their showy predecessors, are equally interesting. The latter I always hail as the harbinger of spring; and when beholding it, enjoy in anticipation all the melody and fragrance of that delightful season. Instead therefore of lamenting the departure of those which are past, let us turn our attention towards the east, and see whether we can recognize the lamps of heaven in that quarter.

B. There are three stars, equally distant, and rather wide of each other, in a horizontal position, about 30 degrees high, due east. What are they?

A. The bright star on the right, is Arcturus in Bootes; that on the left, next to it, is Mirach; observe the ϱ and σ over it; and the other is δ in his shoulder.

B. And above the δ is γ in the right shoulder, and β in his face; and over them, λ in the arm, and the three stars in his hand, to the left of Benetnasch.

A. You may likewise observe Vindemiatrix, in the arm of Virgo, to the right of Arcturus, and midway between it and Denebola.

B. I can also see the four stars in the robe of Virgo, under Vindemiatrix; and Spica, still lower in the same quarter. Nearly all the north-eastern part of the sky is occupied by Draco; Rastaban and Etanin, in his head, being over Vega, now ascending in that quarter.

A. What a beautiful white star Vega is! Between Lyra and Corona in the north-east, I can discern many parts of Hercules.

B. Under Denebola in the south-east, near the horizon, is a four-sided figure, almost square, with a number of smaller stars to the right, rather higher. What can they be?

A. The four are in Corvus; and the other cluster, between that small constellation and the meridian, is Crater, placed on the back of Hydra; whose head you may observe in the south-west, under Cancer.

B. How brightly Capella shines in the west! What three stars are those to the right of it, somewhat lower, in a horizontal line, slightly curving downward, the centre one is the largest?

A. The large star is Algenib in Perseus. Under it, to the left, is Algol; and rather lower, to the right, Almaach in Andromeda; the principal part of which constellation is already set.

B. How easily Cassiopeia is always recognized! Her royal consort, king Cepheus, I perceive on her right, due north. How exactly the α and β point to the pole star!

A. Yes; they are as justly entitled to the name of Pointers, as the well known ones, having that appellation, in Ursa Major.

B. That reminds me we have not yet inspected him this evening. See he is very near the zenith. How much closer the stars seem to each other, and how much smaller all the constellations appear, when near the zenith, than they do when toward the horizon. As we see the Great Bear at all seasons, I have frequently remarked this difference in his apparent dimensions. Can you account for it?

A. I believe the reason of it has never been satisfactorily explained. Of course you have observed a similar difference in the disk of the sun and moon. I understand the diameter of both luminaries is the same in all cases, independently of their altitude. It is probably an optical illusion arising from their being viewed through a much greater mass of atmosphere when near the horizon.

B. The moon's path in this part of the sky is from between the Pleiades and Hyades in the west, above the feet of Gemini, by Prœsepe in Cancer, and proceeding over Regulus, considerably below Denebola, and under the four stars in the robe of Virgo, it descends between the south-east and east by Spica, just risen in that part of the heavens.

CONVERSATION III.

MAY—ELEVEN IN THE EVENING.

JUNE—AS SOON AS THE STARS CAN BE SEEN.

B. How long the twilight lingers in the sky, and how unwilling are the stars to shew themselves! I can just perceive Arcturus, high in the south; and Charles' Wain slowly descending in the north-west; but from the tardy appearance of the smaller stars, one is almost led to imagine they have vanished from the heavens.

A. Ours certainly is not the most favourable climate for studying astronomy. During the clear frosty winter evenings, when the heavens are garnished with peculiar brightness, it is not very agreeable to be long abroad; and in this delightful, balmy season, it is late before the stars begin to twinkle; but see, while we have been conversing, the shades of evening have imperceptibly fallen around us, and the firmament begins to glow with its accustomed lustre.

B. Leo, I see, is sinking in the west. There are the δ and θ on his back and leg, and Denebola to the left of them. That confused cluster, near Denebola, somewhat in the form of a pyramid, I suppose is Coma Berenices; and the star above it, Cor Caroli.

A. They are. And you may likewise observe, in the south-west, Vindemiatrix in the arm of Virgo, equally distant from Denebola and Arcturus. Spica is nearly under Arcturus, but much lower; and Corvus, under the four stars in the robe of Virgo, is almost set in the south-west.

B. Those two stars of the second magnitude, about 20 degrees high, full south, must be Libra. The upper one is to the right. But what is that red, angry looking star, just emerging from the horizon, in the south-east?

A. Antares in Scorpio. Mark those three to the right of it, in a line slightly curved, slanting upwards, towards the left. They are in its head and claw. The southern stars of Scorpio, you know, never rise to us.

B. I wish they did. I should exceedingly like to see the whole. They seem to be arranged on purpose to represent this horrid creature. How far south must we travel, to see the whole constellation?

A. A voyage to Lisbon, or any other part of the earth in about 40 degrees north latitude, would enable you to do so. But would it not be desirable, before you leave home to view the southern stars, that you should become well acquainted with those which may be seen here. For instance; can you find Corona Borealis some way to the south-east of the zenith.

B. Yes, I can.

A. Do you know what constellation is to the east of it?

B. Let me see. I think I do;—yet I am not quite sure; the stars are so scattered, and there are no large ones, to serve as guides.

A. You should look round till you meet with some star you do know. Thus, high in the heavens, a little to the north of the east, is Vega; between which and Corona, you might have remembered, is the large figure of Hercules. I allow he is rather difficult to recognise, but you can distinguish the arms, formed by that line of stars stretching from Lyra to the head of Serpens, under Corona. Those two stars, somewhat lower, and near each other, of the 2nd and 3rd magnitudes, are, one in the head of Hercules, and the other in the head of Ophiuchus.

B. I believe I can trace the whole of Hercules now. Will you oblige me by describing Ophiuchus?

A. Most willingly. It lies to the south of the former. You may observe two bright stars, under each other, in his shoulder, near the head of Taurus Poniatowski; and two smaller ones in the other shoulder, somewhat higher, to the right of Ras Alhague. Now let us trace the long line of stars in this figure and Serpens, commencing with the five in its head, somewhat like an hour-glass, immediately under Corona; beneath these, we meet with α, ε, and λ, close together; lower still, δ, called Yed, and ε in the hand of Ophiuchus; inclining to the left, below these, are ζ and η in his legs; and still further to the left, but inclining upwards, are ν in his hand, and ζ and η in Serpens, under Taurus Poniatowski, between which and Aquila, is θ in the extremity of its tail.

B. I find no difficulty in following you. But what an immense constellation! It extends from the south nearly to the east. I suppose Ophiuchus and Serpens, occupy a greater portion of the heavens, than any other constellation.

A. I believe they do. Aquila and Delphinus are just risen, due east. In this quarter, immediately under Vega, is Albireo in Cygnus. The large cross, formed by its five principal stars, you may easily discern, to the left, in a horizontal position.

B. I can, very clearly. To the north-east of the zenith, I can trace Draco; its head being nearly over Vega; and lower in the same quarter, Cepheus and Cassiopeia.

A. Due north, you may discern the three bright stars in Perseus. To the left of them, in the north west, is Capella; and still farther to the left, Gemini, approaching the horizon, and preparing to bid us farewell for this season.

B. I think I can trace the moon's path, in this part of the heavens. We should first discern that luminary, when a very fine crescent, to the north of the west, under Gemini; in about two days, it would have reached Regulus; thence it would move towards Spica, through Libra, and over Scorpio; and about the full, would rise in the south-east.

A. And you will observe how peculiarly this portion of the ecliptic lies. Extending from north-west to south-east, it never rises more than 30 degrees high. You may therefore, mark the moon at this season, during the first and second quarters, always near the western horizon, setting very soon after the sun; consequently affording us but little light.

B. But I suppose the inhabitants of the southern hemisphere, now derive great benefit from this luminary?

A. They do; and it being their winter, they require it. You may remember that the time the *full* moon is above the horizon to any place, is always as many hours as the day is less than twenty-four; thus, with us in summer, it is present only about seven hours; but, in winter, it shines for more than sixteen.

B. The reason of this I think I can assign. It is because the full moon always rises at sunset, and sets at sunrise.

A. You are right. And it is one of the most delightful employments in which we can be engaged, to trace, as we easily may in this instance, the wisdom and goodness of the Deity, in the arrangements which he has made in nature, for our comfort and convenience, and thus

> "To look through nature, up to nature's God."

CONVERSATION IV.

JULY—ELEVEN IN THE EVENING.

AUGUST—NINE.

B. In consequence of the long continuance of twilight, so many weeks have elapsed since I have looked at the stars; that I am scarcely able to recognize them. Dear me, how they are moved! Hercules and Ophiuchus, which were in the south-east, have passed the meridian, and are now in the south-west; and a corresponding progresssion has taken place in all the other constellations.

A. This apparent advance of the heavens, you remember, results from the annual motion of the earth, and is one of the most convincing proofs of it. Nor is there any circumstance in nature, that more forcibly reminds us of the constant and unvarying course of time. This motion of our planet, causes any star to appear at the same point in the sky, 3 minutes, 56 seconds, earlier every evening, making a difference of nearly half an hour in a week, and two hours every month.

B. Of course. And now let me try if I can make out the constellations, from the zenith to the south-eastern horizon. This bright one, nearly over head, I know is Vega. Eastward of it is Cygnus, along the Milky Way; immediately under Albireo, in its beak, is Sagitta; and descending as much lower, I see Atair, in Aquila, of the 1st magnitude, with β below, and γ above it, in a right line. Beneath Aquila is Antinous, and to its left, Delphinus. There are two bright, though not large stars, one above the other, near the horizon, below Antinous, which I do not know.

A. They are in the horn of Capricornus; you may just perceive Deneb Algedi and δ in its tail, to the left of them. Do you know those large stars, considerably under Cygnus, due east?

B. Let me see. They are to the left of Delphinus. O yes, now I recollect them. They are in Pegasus. There is the large square formed by Markab, Algenib, and Scheat, in that constellation, and Alpheratz in the head of Andromeda; whose two other principal stars, I observe, extending horizontally to the left, in the north-east. I likewise remember that Enif, to the right of the large square, is between Delphinus and Markab.

A. And I presume you have not forgotten, that the three close together, under the mane of Pegasus, are in the urn of Aquarius; between which, and the Goat's Horn, are two stars in the shoulders, and two in the hand of the Water-Bearer.

B. I can discover all these in a horizontal position in the south-east, about 20 degrees high.

A. And now, directing your attention to the north-east, can you tell me what that cluster of stars is to the left of Andromeda?

B. Let me consider. It is below Cassiopiea. I think it must be Perseus.

A. It is. And the constellation over it is Cepheus. Do you observe Alderamin and β between Deneb and the Pole Star at which they point?

B. I do, and that bright star, a little to the east of the north, near the horizon, is Capella. How it twinkles!

A. It does, and I have frequently observed, that the nearer any star is to the horizon the more it twinkles. This would seem to indicate, that their scintillation is caused, either by the intervention of minute particles floating in the air, or by undulations in that fluid, and not by any intermission of their light.

B. Probably it is. For of course, the less elevation any star has, the greater is the extent of air through which we view it. But leaving this subject, we will, if you please, just look at Ursa Major, now engrossing all the north west, except near the zenith, which is occupied by Draco; Rastaban and Etanin in its head being nearly over us.

A. Observe how bright Arcturus is in the west, and how exactly over him, and at equal distances, are Mirach, and δ in the shoulder of Bootes. Just to the left of the latter is Corona Borealis.

B. Libra and Scorpio are slowly setting in the south-west, and that irregular quadrangular figure, near the horizon, full south, is in Sagittarius.

A. It is, and between it and the head of Taurus Poniatowski, forming a small triangle in the Milky Way, are three rather minute stars, in the modern constellation Scutum Sobieski. But we had almost forgotten those two noble constellations Hercules and Ophiuchus. The former you may easily discover by his position between Lyra and Corona, in one direction, and Draco and Ophiuchus, in the other. The latter is now seen, to great advantage, in the south-west, nearly the whole of which quarter he occupies; but as I have on a former occasion described him I shall not do so again, minutely, but merely direct your attention to Ras Alhague, near the head of Hercules, and the long line of stars, in the Serpent, stretching from Corona to Aquila.

B. Those I perceive. And I can likewise clearly discern the head of Aries, just risen in the north-east, under Andromeda, and the two small asterisms, Musca and Triangulum over it.

A. Now will you trace the Milky Way; which glows with great brilliancy.

B. Most readily. It rises a little to the west of the south, in two streams, between Scorpio and Sagittarius. The eastern, which is the brightest, ascends through Scutum Sobieski, Antinous, Aquila, Sagitta, and Vulpecula. The western passes through Serpentarius, Taurus Poniatowski, and, with great brightness, along the neck of Cygnus, where the two divisions unite, and it proceeds onward over the head of Cepheus, through Cassiopeia and Perseus, and reaches the horizon to the right of Capella.

A. You will observe the moon's path in this part of the heavens, extends from south-west to north-east, its whole length being near the horizon. It rises in Libra, passes through Scorpio, over the four bright stars in Sagittarius, under the horn of Capricornus and shoulders of Aquarius, and descends, in the north-east, under the large square in Pegasus. Just allow me to observe, that during the moon's first quarter, the direction in which she is moving, is indicated by her cusps or horns. These always point to her path. Thus, at this season, as her orbit is in a horizontal direction, you will observe one of her horns nearly over the other, but in the spring, when her path is almost perpendicular, they will be nearly level.

CONVERSATION V.

SEPTEMBER—Ten in the Evening.

OCTOBER—Eight.

A. In surveying the heavens, it is very desirable to commence at those constellations, with which we are well acquainted. In the evenings of Spring and Summer, Ursa Major is very convenient for this purpose; and in his absence, I know none more easily recognized, or from which the position of others may be better found, than Pegasus. How striking is the large square formed by his three principal stars, and Alpheratz in Andromeda; now high in the south-east. Immediately to the south of this square, is the oval, representing the southern Zodiacal Fish; and on its northern side, Gloria Frederici. Delphinus may be discovered by Enif, now on the meridian, nearly midway between that constellation and Markab; and the upper star, in the above square, connects it with Andromeda.

B. All those I can clearly see. But what bright star is that, almost alone, considerably under the square, towards the horizon, in the south-east.

A. It is β in the tail of Cetus; the whole of this large constellation is very destitute of stars, and by its uninteresting appearance, forms a contrast, and serves as a foil, to the splendid winter ones, by which it is succeeded.

B. They, I see, are just beginning to appear; the Pleaides and Hyades, being risen in the east. To the right of them, and having about the same altitude, is the head of Cetus, over which I observe the three stars in the Ram's Horns, the largest is rather the highest. Level with them, to the left, is Musca, and somewhat higher, Triangulum.

A. Immediately above these, due east, in nearly a horizontal position, are the three principal stars in Andromeda, and to the left, Perseus and Caput Medusæ.

His leg, you recollect, is directly above the Pleiades. In the north-east, about 30 degrees high, Capella in Auriga is shedding its pure white light.

B. Cassiopeia is very conspicuous in the north-east; but by what constellation is that part of the sky occupied, below Cassiopeia, and between Perseus, Auriga, and Ursa Major?

A. To the left of Auriga is Lynx, and above him, Camelopard; you may observe two stars in his tail, nearly together, to the left of Algenib in Perseus; and two others in his knee, similarly placed, above, and rather to the right of *ο* in the nose of Ursa Major. His head is just under the Pole Star.

B. They are both, I think, very uninteresting. Let us now, therefore, turn our attention to king Cepheus, who occupies a very elevated station this evening, between the zenith and Ursa Minor. What a pretty diamond is formed by the stars in his shoulders, girdle, and the three in his head; and how exactly in the middle of it, is the ξ. I think the *α* and *β* in this constellation, point more exactly to the pole star, than the well known pointers in the Great Bear.

A. I think they do. Can you discover five small stars in Lacerta, to the south of the head of Cepheus, at the edge of the Milky Way, directly over our heads? They form a pretty good W, much smaller than that in Cassiopeia.

B. Yes, I can; and though these small constellations are less striking than the large ones, they are equally interesting. But how beautiful is Cygnus! high in the south-west. What a fine crucifix is formed by its five principal stars! How the Galaxy glows along its neck! It is certainly one of the most interesting constellations in the heavens.

A. Perhaps it is. But observe that large, clear, white star, yonder, high in the west. Can you tell its name?

B. I think it is Vega, and the small one immediately over it, ε in Lyra, the remarkable quadruple star.

A. You are right. And now observe that pretty line of stars in Ursa Minor, curving upwards, and stretching from Alruccabah to Kochab, on the left of the Pole; and next to Ursa Minor, having great elevation in the north-west, is Draco, whose folds, commencing at Rastaban and Etanin in its head, to the right of Vega, wind upward, toward the zenith, and bending to the right, continue their course downward, terminating between the Bears.

B. The last three stars in his tail, are in a horizontal position, immediately over Ursa Major, nearly due north.

A. And he is closely followed by Bootes, Arcturus being just about to descend in the north-west. Those stars of the 3rd magnitude, between Corona in the west, and Ursa Major, are in the upper part of Bootes. Observe the small cluster in his hand, over Benetnasch.

B. I can just see them, and λ in his arm, to the left of that star.

A. We must soon take our leave of Hercules, now descending in the west, between Lyra and Corona; mark the ι and θ in his foot and knee, opposite the head of Draco, and the long line of stars in his arms, reaching from Lyra to the head of Serpens, rather lower than Corona, and on the left of it. Ras Algothi, in the head of this figure, and Ras Alhague, in the head of Ophiuchus, you may perceive near each other, some way to the left of Corona, and rather higher. Ophiuchus is partly set; but the long line of stars in Serpens, may still be seen, stretching from Corona to Taurus Poniatowski, in the Milky Way, to the left of Ras Alhague.

B. I am much obliged by your minute description of this difficult part of the heavens, and think I know the remainder. Let me consider. The three bright stars in a line, under Cygnus, to the right of Delphinus, are in Aquila. The large one in the centre is Atair. The two to the right of them, in the other branch of the Milky Way, are ε and ζ in his tail; the latter, on the left, is rather lower and brighter than the other. Sagitta is between Atair and Albireo. The stars in Antinous, under Aquila, are very faint and misty. Just by that brilliant cloudy spot, in the Milky Way, to the left of Taurus Poniatowski, is Scutum Sobieski.

A. You may always discover this little asterism, by its position to the right of the foot of Antinous.

B. Sagittarius is principally set in the south-west. Capricornus is on the meridian, about 20 degrees high. I always know him, by the two stars, one over the other, in his horns, and from these, it is easy to discover Aquarius by the ϵ and μ in his hand, and the α and β in his shoulders, all of which are in a right line, the α being very near the urn of Aquarius, under the neck of Pegasus. Fomalhaut, in the Southern Fish, I perceive just rising between the south and south-east.

A. Will you trace the Milky Way, which is peculiarly brilliant this evening?

B. Most willingly. Commencing in the south-west, at the horizon, I observe it ascends in two distinct branches. The most southerly passing over Scutum Sobieski, Antinous, Aquila, and Vulpecula et Anser, while the other, to the right, ascends through the arm of Ophiuchus, Taurus Poniatowski, and the neck of Cygnus, in which constellation they both unite. Near the zenith it touches the three stars in the crown of King Cepheus, and descends through Cassiopeia, Perseus, and Auriga.

A. Quite right. How it glows in the neck of Cygnus, and what beautiful clouds of it are those below him in the south-west. You may remember that it was between γ in the breast of Cygnus and β in his beak, that Dr. Herschel had fields of view through his telescope, that contained nearly 600 stars in each, and these were continued for many minutes.

B. How I should like to survey this region of the heavens through one of his large glasses. And now we will, if you please, endeavour to trace the moon's path.

A. Most willingly.

B. It commences in the south-west, in Sagittarius, passes under the horn of Capricornus, below the shoulders and urn of Aquarius, considerably under the square of Pegasus, below the horns of Aries, and between the Pleiades and Hyades, just risen in the north-east.

A. You will observe that this part of the moon's orbit, lies very obliquely to the horizon; and as the full moon, in the autumn, happens in Pisces or Aries, yonder in the east, you may observe her rising, a few days previous to the full, just before sunset, near the south-east; and a few days following, towards the north-east, soon after sunset; there being little more than two hours' difference in the time of her rising, for about a week. This constitutes the peculiarity in what is called the Harvest Moon.

CONVERSATION VI.

NOVEMBER—Ten in the Evening.
DECEMBER—Eight.

A. Amongst the pleasures derived from Astronomy, may be reckoned, that which we receive from the succession of the constellations. As the months roll on, the face of the heavens is ever changing, each bright assemblage remaining long enough for us to examine and admire its beauties, when it almost imperceptibly moves off, to make way for its successor.

B. And even the constellations which never set, assume a different appearance from the alterations in their position.

A. We owe this variety to the annual motion of the earth, of which, as I have before observed, it is the most convincing proof. This continual change, renders it a pleasing employment, to watch the first appearance of each constellation; to catch the first sight of some bright star in the eastern horizon, which, after long absence, we recognize and welcome as an old acquaintance. For instance, yonder are Taurus, Gemini and Orion, the ornaments of our Winter skies, ascending in the east.

B. I think there is not only greater beauty in these, than in the constellations generally; but also rather more propriety in their formation; thus, how ingeniously is the constellation Gemini arranged! and how aptly are the shoulders, feet, and belt of Orion marked by large stars! Taurus is certainly an exception; for, although very beautiful, yet it requires a fertile imagination to discover any resemblance between the form of its stars, and that of a bull. But leaving that subject, we will, if you please, endeavour to determine to which of the honourable company of gods and goddesses, animals, rational and irrational, who have been placed in the sky, each of these golden lamps of night has been appropriated.

A. If you please. Suppose we commence with Ursa Major, who is no longer journeying downwards; Benetnasch, the last star in his tail, is just passing the north, as you may observe by its position under the Pole; look how he points his fore foot at Castor and Pollux, and his hind one is just rising between the north-east and north. His position indicates the seasons very correctly. We always find him in the north-east during the Winter evenings, overhead in the Spring, north-west in Summer, and below the Pole during Autumn.

B. As the evening is unusually clear, I think I can discern the cloudy spot, Prœsepe in Cancer, under Castor.

A. And considerably above Gemini is Capella. What a pretty triangle is that, formed by those three bright stars on its right!

B. What a beautiful cluster are the Hyades, surrounding the ruddy Aldebaran! They are ascending high in the south-east, between Orion and the Pleiades.

A. That pretty knot of stars is very useful in directing us to Perseus, whose leg is just over it, from which you will have no difficulty in discovering the whole of that important constellation, extending from the neck of Taurus to the zenith, especially as it is principally in the Milky Way. Midway between the Pleiades and the zenith, is Algol, the variable star, of the second magnitude.

B. I should like to observe the alteration in its size. What is the best method of doing this?

A. By comparing it with some neighbouring star. Algol is usually much brighter than ϱ just beneath it, but when shining with its least light, is somewhat smaller. As this phenomenon occurs every three days, you will, by directing your attention to it, probably soon be gratified.

B. I hope I shall. I think you informed me, some time since, that Lynx occupied that uninteresting part of the sky, in the north-east, between Gemini, Auriga, and Ursa Major, and that Camelopard is found somewhat higher, between Auriga and the Pole Star.

A. I did, and as there is nothing in them particularly worthy our notice, let us direct our attention to the meridian. Cassiopeia is so near the zenith, that it is painful to look at her. To the south, we find Andromeda. Observe, how obliquely the three principal stars lie across the meridian, Alpheratz on the right, being the lowest; there are two stars over Mirach, and just above the upper one is the nebula, so often taken for a comet, to which it bears a strong resemblance.

B. It does; and rather to the left, under this poor lady, who has so long been chained in the sky, I think I can recognize Triangulum and Musca, over Aries, which is distinguished by the three stars in his horns, the largest, Arietis, on the left, being rather the highest.

A. It is; and the three small stars on his back, are to the right of the Pleiades.

B. Below Aries is the head of Cetus.

A. It is; and particularly notice that Mira, the variable star, is not visible this evening. You remember the rule for finding it. Pass your eye from Menkar to δ, the lower of the two stars in his mouth; and in the same direction, exactly as far further, you have the place of Mira.

B. The four large stars, on the body of this huge creature, forming an irregular quadrilateral, I see are full south; the upper one on the left is Baten-Kaitos, and has a small star beside it. Between Cetus and Orion, in the south-east, flows the Eridanus.

A. Now direct your attention to the interesting constellation, Pisces, in the south, to the right of Aries. Observe the two distinct lines of stars, meeting at the α in the neck of Cetus, and thence proceeding, one to the Northern Fish, under the arm of Andromeda, and the other, to that pretty oval, of about eight small stars, in the Southern Fish, under the large square of Pegasus. This flying nag makes a splendid appearance in the south-west. You may likewise notice Equuleus, between Enif and Delphinus, which, with Aquila, are fast descending in the west. Aquarius likewise is approaching the south-west horizon, and will soon disappear.

B. King Cepheus has resigned his station on the meridian, to Cassiopeia, and is now high in the north-west. I can discover him by the α and β pointing to the Pole Star. From the Ethiopian monarch to the horizon in the north-west, Draco twists his numerous folds; the bright stars in his head are very plain, to the right of Vega; Etanin on the left, being rather higher than Rastaban.

A. And observe the large crucifix, formed by the principal stars of Cygnus, over Lyra. How perpendicularly it stands! I cannot help thinking, that whether rising horizontally, or setting in its present position, it is one of the most beautiful of the stellar formations.

B. The Milky Way, I observe, at this season passes through Cassiopeia in the zenith, and descends towards the west, by the head of Cepheus, and along the whole of Cygnus. In the east, it passes over Perseus and Auriga, and between the feet of Gemini and Orion.

A. Before we conclude our evening survey, I will direct your attention to the course of the ecliptic, with which, you know the moon's orbit nearly coincides. It rises in the south-east, and passes under the principal stars in Aquarius, proceeds to the south of the Fishes, and between the stars in the head of Aries and those in the head of Cetus, between the Hyades and Pleiades, over the feet of Gemini, and descends in the north-east, considerably to the left of Procyon, which has just risen in that quarter.

B. I can trace it very readily, and trust I am become much more expert in recognizing the constellations than formerly. The process of tracing the moon's path has been a source of much pleasure. I never see that luminary, without calculating its place for two or three nights to come, and have usually had my predictions verified.

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